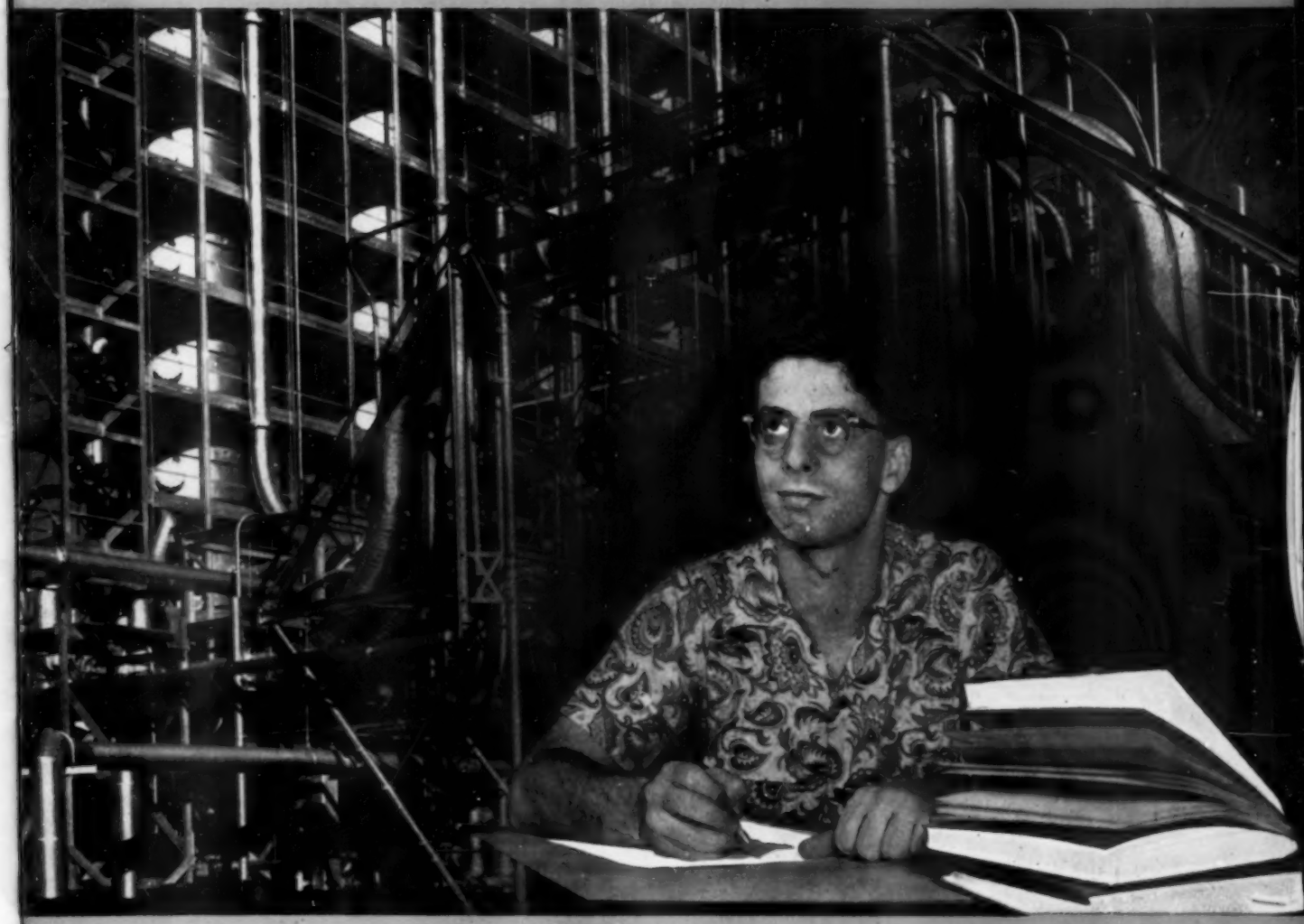
OCTOBER 1950

THE SCIENCE TEACHER



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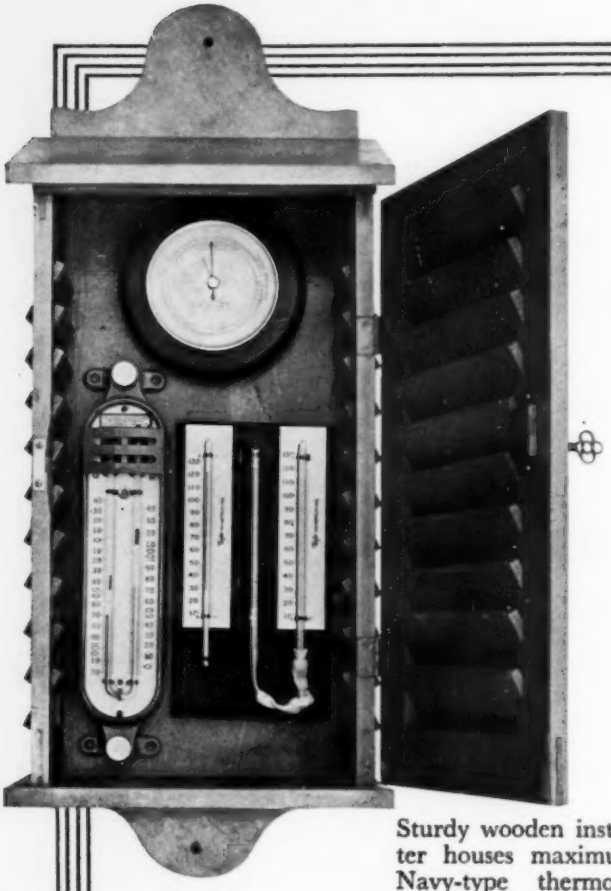

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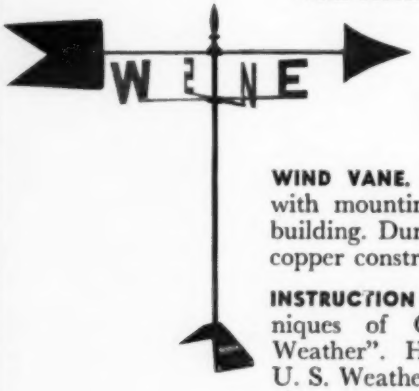

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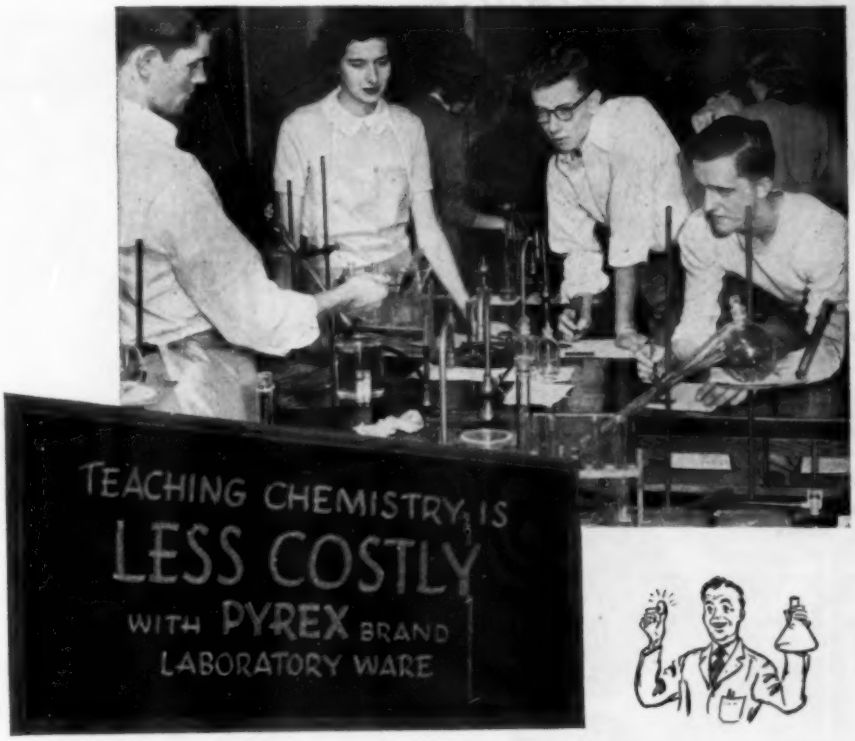

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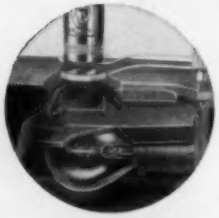

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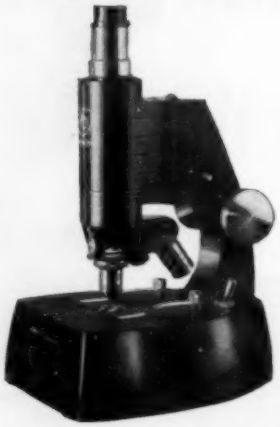

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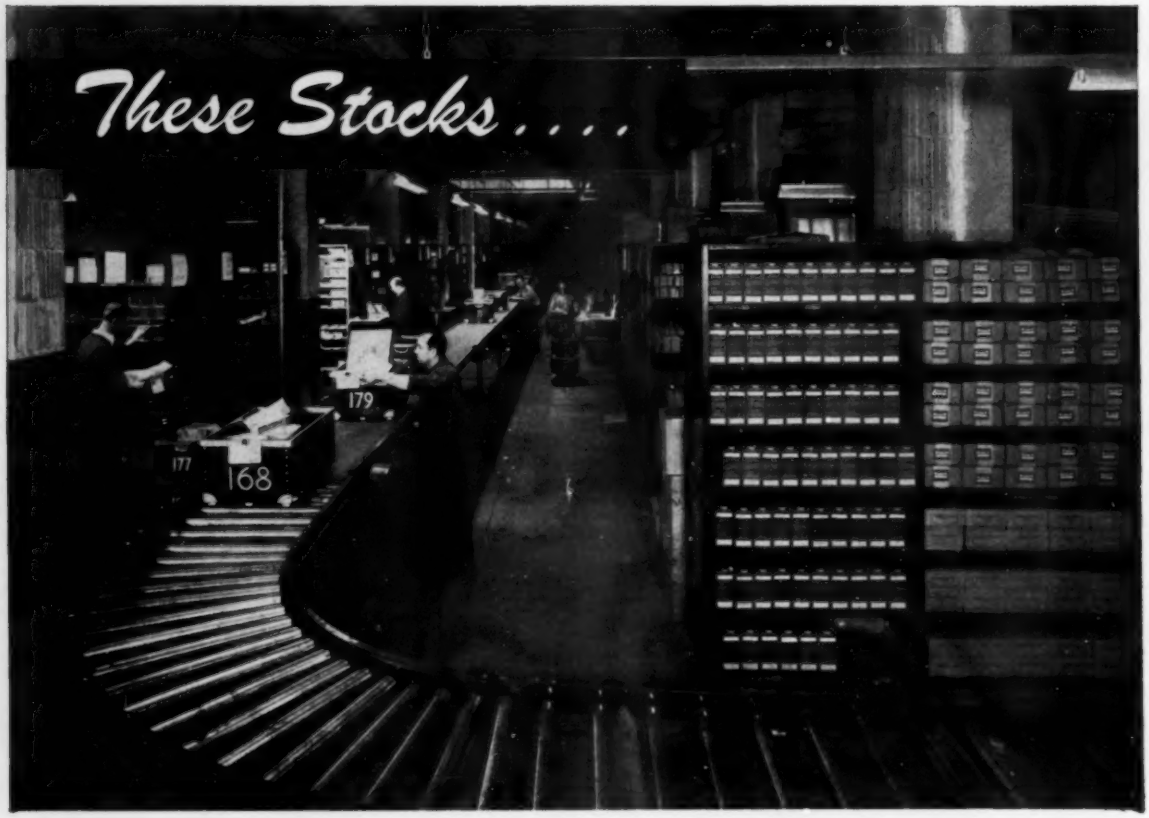

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THIS MONTH'S COVER. Not too long ago Hans Weinberger, the son of an Austrian physician, frequently took time from his high school studies to dream of a science career. At 16 he won a trip to Washington as one of the Science Talent Search winners for 1945, demonstrated the principle of his self-inflating life raft to the Army and Navy, and made a real contribution to the war effort. Today, at the age of 22, Dr. Hans Weinberger (B.S., M.S., Sc.D.) is making his dream come true, while studying at the University of Maryland on a postdoctoral fellowship.

Photo: Science Service, Washington

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National Science Teachers Association

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The Voice of Science Education—

Philip G. Johnson

President

1944–46

Our association, as the Department of Science Instruction of the National Education Association, was established in 1895. Our relationship to the American Association for the Advancement of Science goes back to 1936. During all the years up to 1950 we have been without a regular publication of our own. Now, with this issue, we take a significant step forward in our efforts to improve science teaching.

The association has achieved more than the ownership of a journal; it has avoided adding a new publication to the field. Mr. John Chiddix started *The Science Teacher* as a simple bulletin in which a few science teachers shared their ideas. He and many others have poured time, thought, and devotion into it. I remember well the help he gave during our professional rebirth in 1944–46. He has been one of us, and it is fitting that his journal should come to be our professional publication.

We now have new and great opportunities. Since we are an association of elementary, secondary, and junior college teachers interested in the biological, physical, and earth sciences, we can encourage both broad and specific improvements. We can use our journal to share our best ideas on materials, activities, plans, and developments. Let us take our pencils in hand and help meet the challenges of our new opportunities and responsibilities.

Morris Meister

President

1946–48

We once bemoaned the fact that science teachers had no "voice." While they made many individual contributions, there was no organization that could speak for them as a group. Their voice was weak, it had not been heard very often, nor was it respected. Taking stock at that time, we found at least sixteen vital activities affecting science education in which no one had thought of consulting organized science teachers. Local and regional groups hesitated to give NSTA support, fearful that that might detract from their own strength.

In six years we have gone far to build a voice. NSTA is now the largest science teachers group in the country. It is the only national association concerned with *all* science teaching problems at *all* levels. Fifty local associations are affiliated with NSTA. It has the support of educators (NEA) and of scientists (AAAS). Industry has been attracted to NSTA because it conceives of science teaching as something which goes beyond the confines of the classroom. Hence, industry has lent support and made possible a budget ten times the size it used to be. NEA has helped NSTA to a full-time executive secretary and to its own magazine.

The time has come when our strengthening voice should be used. There are crying needs in science education which must be met. Our yearbook on *Time for Science Instruction* must be implemented. Scientific illiteracy is still rampant. Laboratories are slowly being eliminated from secondary schools. We are not doing enough to discover and to cultivate science talent among youth. We must strive mightily that the spirit of science and the democratic faith with which it is entwined shall assume their rightful place in the affairs of men.

—Letters From NSTA Past Presidents

Norman R. D. Jones

President

1948–49

A long-standing goal is now achieved—an NSTA-owned journal. It is certainly gratifying to culminate the arrangements whereby NSTA has passed another milestone in its rapid advancement. *The Science Teacher* has been a very valuable adjunct in bringing much needed information to the "grass-roots" teacher, in a practical form, easily usuable in the classroom.

A past-president's prerogative—a reminiscence: our main parent organizations, each felt the need of a regular publication for its membership. At its annual meeting held in conjunction with the AAAS meeting at Dallas, December 29, 1941, the ASTA adopted *The Science Teacher* as its official journal. The ACST at its annual meeting in July, 1942, held in Denver in conjunction with the NEA, accepted a similar proposition presented by Mr. John Chiddix, its editor and owner. Then, in 1944, the ASTA and the ACST merged their endeavors under the name of the National Science Teachers Association.

The hybrid vigor engenderd enabled many rapid advancements—the acquisition of *The Science Teacher* as the latest achievement. As one who has actively participated in the deliberation making these progressive steps possible, it is my hope that this "new" *Science Teacher* will continue to serve all teachers, giving them the essential aid and assistance necessary to bring the latest developments, in a usable form, to each and every science classroom.

Nathan A. Neal

President

1949–50

The official birth of the National Science Teachers Association took place six years ago. This event resulted from long effort on the part of many science educators from the elementary, secondary, and higher education levels. The members of the small committee which formalized the first Constitution and By Laws during that long weekend in Cleveland in September, 1944, represented the point of view of various science teacher groups from wide points of the compass. All had seen the need for unification in an association which would speak for all of science education.

In the intervening years there have been problems; but, happily, most of them have been of the order of growing pains. There have been disappointments, but these were far outnumbered by achievements. NSTA has served science teachers. The evidence is in membership which has grown from a few hundred to several thousand.

Two services stand out for special citation. One of these is Robert H. Carleton, executive secretary for the past two years. His presence enhances, indeed personifies all other services. The second is *The Science Teacher,* of which this is the first issue under NSTA ownership. This journal, edited by Mr. Carleton, and "put through the mill" by his able associate, Mrs. Mary Ellen Brain, seems to me to ensure increasing service to our members and increasing strength to the association. We have, at last, an adequate voice for the unified science teachers of the nation. Here, then, is the opportunity—and the responsibility—for science teachers everywhere to join in bringing their story before the profession at all levels of instruction, and beyond to all areas of life.

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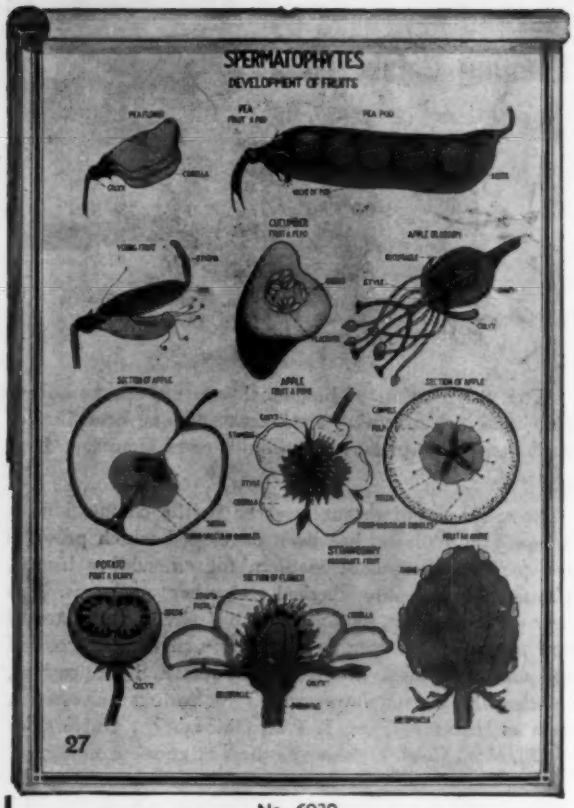

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The Place of Science in a Free Society

By Commissioner HENRY D. SMYTH
United States Atomic Energy Commission

The functioning of scientific research is producing results of increasing significance in the daily lives of all our people. But let us pause to ask: How secure is the scientific enterprise? How has it fared under authoritarian governments and in free societies? What conditions favor the advance of basic science and of technology? These are questions touched on by Dr. Smyth in this article. Let us ask also: Need science teachers be concerned with such questions? If so, how can we be properly concerned in our teaching? Implications for all levels of instruction, as seen by science educators, are given at the end of the article.

"The Place of Science in a Free Society" implies the assumption that we are all convinced that we want a free society but are wondering whether science has any place in it. There is no quarrel with this assumption. If I had to choose between freedom and science, I would choose freedom. But it does suggest the order in which a discussion of this type should be arranged. I shall first try to give my definition of a free society.

Every modern society is a cooperative society, and every modern society is governed by a vast complexity of rules and regulations, of laws which have been imposed upon it either from above or by the people themselves in order that cooperation may be carried forward to the greatest advantage in terms of the material welfare of the people, or at least of certain groups of the people. Yet, we say that certain societies are free and that certain others are not. What do we mean by this distinction?

We consider that a society is free if a man may choose his job, his place of residence, and the way in which he employs his leisure hours. Above all, we say that a society is free if the men and women in that society can say what they please when they please and are free to question and criticize everything around them.

It has been necessary to attempt this definition of a free society in order to relate the atmosphere and activity of science to the society in which it exists. For this purpose, then, the definition will be limited to one in which thought, and speech, and choice of profession are free.

At the outset, it is important to distinguish between basic science and applied science, or technology. The objective of science is to understand the laws of nature, while the objective of technology is the immediate improvement of the material condition of man.

The primary motive that leads men to study the behavior of nature is intellectual curiosity, a very personal desire to understand the "how" of things. It is, perhaps, an instinctive desire to find order and law in an apparently chaotic world, a wish to understand our surroundings in order that we may be less afraid.

Whatever it is that turns men toward science, the first impulse is toward speculation. Its requirements are skepticism and imagination, an inclination to question accepted views, and the imagination to construct novel interpretations and theories. These characteristics are, of course, not confined to scientists but are essential to all creative thinkers. Such men are often called impractical, and, in a sense, they are.

But the scientist who first indulges in speculation usually goes on to observation. In fact, observation may often precede speculation and may be of a very practical kind. And the observations are likely to be followed by experiment. Once a scientific man begins to experiment, he has to get practical. Thus, it is only a small step in method, perhaps no step at all, from the work of the experimental physicist to work in applied science, or technology. Yet, it is a big step in motivation.

The motivation of individual men interested in the workings of nature is a very personal characteristic. But this does not imply that a typical scientist is an isolated hermit shunning contact with other human beings. With the growth of knowledge about the laws of nature over the past three hundred years, it has become evident that no one man can understand more than a fraction of what goes on around him. Consequently, those who have an eagerness to understand nature have learned to cooperate with each other and have developed a language by which they can talk with each other precisely.

Out of this cooperation there has developed what one might call a group motive—a motive of a little more philosophical nature than the mere curiosity of an individual. It is a desire to understand all the

laws of the physical and biological world. At one time, it was thought to be a perfectly reasonable program. In fact, it was thought that the whole universe, including the behavior of man, could probably be understood in the terms of the laws of mechanics. In the last fifty years, however, we have become much more humble, and few of us now suppose that we will ever work out completely all the laws of the physical and biological world, much less those that govern the human spirit. Even this more limited program confines itself to the "how" of things rather than the "why." Occasionally, scientific men turn into philosophers, sometimes to the advantage of philosophy and sometimes not, and then the "why" of things becomes their problem.

Utility Motivates Technology

Turning now to the engineers and inventors who represent the workers in technology, we should hesitate to suggest that they have no curiosity about the laws of nature. Yet it is clear that their standard of success is utility rather than understanding. The research engineer or inventor is interested in new ways of doing things, cheaper methods, or more effective methods. His object is an immediate and practical one. But, in differentiating between the aims of science and technology, let us not under-estimate the value of technology. There is nothing inherently evil about being useful. In fact, science in its present form could not exist without the strength that technology brings to our society.

Technology is dependent upon science in an even more direct way. For a long time, technology consisted largely of mechanical devices, levers, cogwheels, pulleys, pistons, and the like. Their success depended upon simple, mechanical laws that were often sufficiently apprehended by inventors without any knowledge of the general laws of physics or chemistry. This situation began to change with the advent of the electrical industry in the last half of the nineteenth century. The gap between the methods of technology and the methods of science began to close. In the two decades between World Wars I and II this tendency was accentuated. The gap of only six years between the discovery of nuclear fission and the explosion of the atomic bomb is the final dramatic demonstration of the shortening time between scientific discovery and technological application.

This change has had a number of effects. It emphasizes the increasing dependency of technology upon basic science. This has meant an enormous increase in the funds devoted to scientific research by industry and by government. Such funds are badly needed in view of the increasing costs of scientific research and the serious financial straits in which our universities find themselves.

On the other hand, there are obvious dangers. The technological value of science may be wrongly considered the main reason for scientific research. Research on fundamental problems may continue, but preference will be given to those problems which appear to have ultimate technological value. Such judgment requires foresight that is beyond the capacity of the human mind. Examples show that the value of science to technology comes from totally unexpected quarters and that the only safe objective to set up for science is the one which it has already set up for itself, an increased understanding of the laws of nature.

This danger is well understood by those now administering the government funds devoted to science and is also understood by men in similar positions in industry. It probably is not well understood by men who have no familiarity at all with science and technology. That is why this point should be emphasized, since ultimately funds to support science come from ordinary citizens, either through taxes or gifts.

In considering the conditions favoring the development of science, one naturally turns to history. Here one finds not only that science has flourished under a variety of social and political conditions but that the needs of scientific research have changed with time and vary with different branches of science. Yet we shall find certain factors always present in the environment of the outstanding scientists of the past and present.

Scientists Need Economic Freedom

First of all, to pursue scientific research, a man must have a means of livelihood independent of the immediate results of his researches. This has taken a great variety of forms—in early times often a stipend from a wealthy patron, sometimes a government job of not too heavy responsibilities, sometimes independent private wealth, and, in recent years, most frequently a university post. All of these possibilities imply a certain degree of prosperity in the society in which the scientist finds himself.

In addition to economic freedom, there must be intellectual freedom. Let us be honest. Such freedom does not have to be universal in scope for every scientist. If a man chooses to work in fields far removed from the strongly-held beliefs and prejudices of his time, he may suffer no interference. However, the ideal is clear. There must be

complete freedom to question and criticize accepted theories and points of view, to examine any new idea, however revolutionary, so long as the examination is calm and objective.

But economic and intellectual freedom do not automatically produce science and scientists. They are apparently necessary but not sufficient conditions. We have been prosperous and politically free in this country for a long time, and yet our record in fundamental scientific research is unimpressive. There is something else required—a positive stimulus, a ferment in men's minds, an atmosphere of inquiry. It is doubtful that an interest in developing science as a background for technology is sufficient. There must be a spirit of inquiry and investigation abroad in the land. There must be an enthusiasm for the excitement of entertaining new ideas and of bringing to bear the full power of the mind on them.

The conditions favoring the development of technology are more easily defined. The history of this country illustrates such conditions. We had a vast storehouse of natural resources, a relatively small population so that labor was at a premium, a vigorous and ambitious people eager for material benefit and for practical results, and, of major importance in recent years, the scientific discoveries of Western Europe were ready for us to put to use.

Comparing technology with science, it should be pointed out that technology pays for itself so that in this field a man's livelihood results directly from his work. Freedom of thought is important but probably not as much so as for basic science. As to the intangible influences, interest in abstract thinking is here replaced by interest in practical thinking, in ways to achieve an end. That these are different is demonstrated by our brilliant record in technology in contrast to our mediocre contributions in basic science.

So far we have considered the nature of science and of scientists and the conditions under which they are fruitful. It should be clear that science is at least congenial to a free society, that it is a natural and proper activity for the members of such a society.

The discovery by Copernicus that the earth was not the center of the universe had a profound effect on the thinking of men. This was a great step forward in understanding the laws of nature. It enlarged the minds of men and helped to set them free from prejudice and superstition.

At the time of the formulation of the theory of evolution by Charles Darwin, the practical importance of the discovery was not great, but the effect on men's attitudes and philosophy can hardly be overestimated. It is an example of the storm that can arise, even in a relatively free society, when a scientific discovery goes contrary to long-held and cherished beliefs. Darwin's ideas had more serious effects through their influence on the German philosophers. By distorted interpretation, the theory of evolution became one of the justifications for the German belief in their race supremacy and in their right to rule the world.

A third example to illustrate the effect of theoretical science on men's minds is the theory of relativity—namely the reaction of the public to Einstein's ideas of time and space as expounded in the first 25 years of this century before there appeared to be any possible usefulness to his theories. It became the subject of conversation over the dinner table, and there were innumerable popular books and lectures about it. It is true that few understood what it was really about, yet many did catch the fascination of so drastic and penetrating a study of our accepted beliefs about time and space. Everyone felt better for knowing that one man's mind could encompass ideas of such scope and penetration.

It is probably less necessary to discuss the impact of technology on society because it is so inescapable. One can, of course, draw up a vast list of technological devices and processes that have greatly affected our whole economic and social structure. It is annoying to hear so frequently the suggestion that the only contributions science has made to our culture are such things as refrigerators, telephones, automobiles, and radios. Yet it would be unrealistic to suggest that these are not important. One may, for example, question whether this country would ever have developed as a single relatively harmonious political and cul-

HENRY D. SMYTH, professor of physics, Princeton University, was appointed to the United States Atomic Energy Commission in 1949. He has been on the Princeton faculty since 1924 and served as chairman of the physics department, 1935–49.

Commissioner Smyth holds the Ph.D. degree from Princeton University and the Ph.D. degree in atomic physics from Cambridge University.

tural unit if the technology of communication had not grown even more rapidly than the country.

The rapidly diminishing time interval between discoveries in science and their application to technology has been mentioned earlier. This is particularly marked in the technology of war where the desperate need of survival has speeded up normal processes of application and development.

It is sometimes thought that the vast expenditures made on experimental work during the war were expenditures on science. This is not correct. Actually, scientific research came almost to a complete halt in this country between 1940 and 1946. What the scientists were doing in this period was to apply the knowledge and techniques they already had to practical problems of warfare.

Even from the most narrow point of view of national security, it was clear after the war that basic research must be resumed and that men must be trained to do such work. At the same time, we are confronted with the need of secret research for the further development of weapons of war. We have, therefore, to learn to live in a scientific world that is today only partly free. This leads us to a reassessment of the importance of freedom in science and its relation to freedom in the society as a whole.

Creativity Needs Freedom

We have heard a great deal of talk in the last few years about the need for freedom in science. Let us consider honestly whether freedom of science is just an agreeable tradition or is, in fact, necessary for its vigor. Let us assume we are willing to discard the motivations of pure science which I have tried to describe and consider science merely as a direct contributor to our military and industrial technology. If we assume this position, we must still consider the kind of people scientists have always been and the conditions which have always been necessary for creative work. The inescapable conclusion is that a free society is necessary to creative science.

If we study the reasons for the failure of Germany to develop an atomic bomb, we understand how party politics, limitation of criticism, exaggerated national conceit, and racial intolerance can strangle even technology. It will be interesting to see how far the Russians will get in their attempts to apply theories of genetics based on party fanaticism rather than on scientific evidence.

Some of the things that happened in Germany and are happening in Russia could happen here. They will, unless we face squarely the troubles in which American science finds itself today and work constantly to keep them within bounds. We are in a dilemma that is not confined to science and technology but is more acute there than elsewhere. It can be simply stated by the questions: How much should we talk? Or, how much talk should be permitted?

This problem of secrecy is one that needs constant review and debate such as can occur only in a free society or in a nearly free society. However, it would be better if the debate did not sometimes become hysterical in tone and selfish in motive and if the indirect costs were not so high.

We must remember that our future strength in military technology cannot depend entirely on work in secret governmental laboratories. It will certainly depend also on the vitality of our educational program, on the research of innumerable university and industrial laboratories, and on the progressiveness of our industrial technology. A policy of exaggerated secrecy would destroy the very strength it was intended to protect.

The indirect effects of our secrecy policy are more subtle and, therefore, more dangerous. The extraordinary exaggeration given to the importance of secrecy in the public mind is of great concern. We must not accept the false notion that the safety of the country depends on espionage laws, loyalty oaths, and FBI investigations, and that the more of these you have, the more secure you make the country's future. These measures are evil and enervating for they are against the traditions both of science and of the free society in which we live. Our future depends on the strength of our free institutions and free men, even including free scientists. In science, in technology, and in political action, we must depend not on negative restrictions, but on positive achievement.

Science Essential in Free Society

In conclusion, let me sum up the reasons for thinking that science is an essential activity in a free society in the modern world. The reasons are three:

First and most obvious: Basic scientific research is the foundation of modern technology. A vigorous technology is essential for economic welfare in the world of today. It is necessary for the defense of a free society. It has become the very sword and buckler of freedom.

Second, by its study of the universe around us, science gives an understanding of the natural laws that govern the universe. It is the foe of ignorance and prejudice. It substitutes knowledge and understanding for superstition and fear. It teaches and

practices cooperation in an atmosphere of disciplined freedom.

Finally, a free society is the finest political goal toward which mankind can aspire. The structure of modern science is the greatest collective achievement of the human mind. To build it has required patience and vision, imagination and discipline, cooperation and honesty. To study it and to add to it will continue to foster these qualities. If we lose them, we lose science and we lose freedom. If we strengthen these qualities, we will have a strong science. More important, we will have such independence and vigor of mind and heart that no power on earth can take our freedom from us.

Implications

For the Elementary Level

By ABRAHAM RASKIN

Assistant Professor of Biological Sciences and College Examiner, University of Chicago

It is difficult, and for that this discussant is grateful, to distinguish between the implications of Commissioner Smyth's paper for elementary education and those for elementary science education. The paper, indirectly, is a strong argument for the institution of an integrated curriculum.

Obviously, if our children are to understand the roles of science and technology in a free society, it is one of our first functions to acquaint them with the background, bases, and characteristics of our own society *and* of others. We can, even on the elementary level, by precept and through a humanistic approach, give children a basis for later understanding the relation between the scientific activities of a society and the tenets on which the society is founded.

It is high time that we in elementary science education discarded, completely and permanently, the "science" curricula based entirely on cookbook techniques and those consisting of collecting, pressing, mounting, classifying, and naming activities. Our course has been set for many years. We need to urge the universal adoption of a functional curriculum which recognizes the needs, interests, and abilities of children.

(*See* IMPLICATIONS—ELEMENTARY, *page 142*)

For the Secondary Level

By MORRIS MEISTER

Principal, High School of Science, New York City

It is a happy circumstance that the lead article in our new *Science Teacher* deals with the most critical problem of modern times. Free society has never before been attacked so viciously, so insidiously. Though not the first to point this danger, Dr. Smyth is one of the few to establish the symbiotic relation between freedom and science. When one grows sick, so does the other; when one grows strong, the other cannot remain weak. Were mankind to understand this relationship and its implications for everyday affairs, undreamed of advances would quickly follow in both modern science and in world peace.

But the advances do not come and the dreams remain unrealized. Why? Dr. Smyth does not give the answer. Who can? It is one of man's cardinal failures that he does not love freedom so dearly as to tolerate intolerance. Hence, society must become something less than free. The same inconsistency then spreads to scientific endeavor. Secrecy is exaggerated because man is fearful of helping the enemy of freedom.

(*See* IMPLICATIONS—SECONDARY, *page 143*).

For the College Level

By FLETCHER G. WATSON

Associate Professor, Graduate School of Education, Harvard University

This article is directly in the spirit of Dr. J. B. Conant's book *On Understanding Science* which subsequently has been developed during three years through a collegiate course for "non-scientific" freshmen. Such broad approaches to science as a social activity are at first disconcerting to students who have previously found that "remembering the text" and "getting the right answers" were the criteria of success in science courses. Realization that scientific ideas have influenced history, economics, and social thought comes as a surprise, but adds much significance to further studies in the social areas.

No amount of telling will convince the student that scientists are real people with prejudices and personal problems. This must be discovered by the student through intimate contact with scientists at

(*See* IMPLICATIONS—COLLEGE, *page 146*)

Science Learning Through Books

—*in the Elementary Field*

By HERBERT S. ZIM

Associate Professor of Education, University of Illinois, Urbana

SCIENCE learning is not a simple process but is as diverse as the two component words—science and learning—imply. It is as diverse as the questions children ask and the problems they raise. Many problems and questions involve science learnings if Harry is to find a solution, and if Jane is to be satisfied (at least temporarily) with an answer. The role of books in this process is an essential but often misunderstood one. No one doubts the importance of a hammer in building a house or the foolhardiness in using that tool to the exclusion of all others. The frequency with which science questions and problems are turned into reading exercises is a matter of deep concern. Yet if books are to serve as a tool in science learning, much more skill is needed in using them. This includes learning to use old tools well and, more important, to learn to know the newer or better tools —or books—as they appear.

Because there is much more to science than providing a ready answer to children's questions, parents and teachers must learn to use books so that they will stimulate rather than stifle curiosity; so they will lead to action instead of substituting for it; and so the child will remain inquisitive, questioning, and experimentally minded, and not stopped dead in his tracks by an authoritarian answer.

A decade or so ago the problem was more acute. Science for children was still new and somewhat scary for teachers. The security that encyclopedias and "standard references" seemed to offer turned out to be an illusion, for these (and even the books written for children) were often wordy and ponderous. Their frequent function, in the words of James R. Newman, was to leave the child "with a fresh set of confusions in place of ignorance." Authors of science books dared you to open them up and challenged you to read further than the first few pages. There were exceptions of course. Grenfell's *Yourself and Your Body* (Scribner, 1924) still holds the interest of upper-elementary children as much as any good story. Several of the nature books of the last generation still hit the mark. So do a handful of others.

However, during the past 20 years the number of scientific and informational books for children has doubled and redoubled. They now number well into the hundreds. It is not easy to trace this stream of effective science writing back to the springs from which it welled. The ambitious educator who can account for this phenomenon will well earn the Ph.D. or Ed.D. that should cap his efforts. These newer science books were clearly evident in the early thirties. W. Maxwell Reed's *The Earth for Sam* (Harcourt, 1930) fully deserved the applause that greeted it. *The Stars for Sam* (Harcourt, 1931) and Wilfrid Bronson's *Pollywiggle's Progress* (Macmillan, 1932) followed the same pattern. From then on they came thick and fast.

Children "oh" and "ah" at these newer scientific juveniles. Parents and teachers find them manna from heaven. If those who buy books on limited classroom or library budgets raise an eyebrow at this metaphor, it must be admitted that prices are up. Books never come as freely as the Biblical manna, but in all fairness, the quality of the product is so improved that money spent on informational books is well spent. .

Of quantity, there is no question. During the 1949–50 school year some two dozen science books for children piled on my desk for review, and I can match them with an equal number which did not reach me first hand. Hence no apology is offered because the following paragraphs do not completely summarize the recent output much less all the books on science and related fields which have become so popular since the war. Consider the samples included as an inducement for your further exploration.

Webber's *It Looks Like This* (Scott, 1949) is highly original in attempting to clarify for young children the scientific concept that things look different from different points of view. Dr. Irma Webber is as successful here as she was in her earlier books. Her *Up Above and Down Below* (Scott, 1943) is literally a first book about plants and is a classic example of a scientific book for the nursery set. *Travelers All* (Scott, 1944) tells the

story of seed dispersal, while *Anywhere in the World* (Scott, 1947) is a roundup of plant, animal, and human adaptations to the world's varied environments. *Bits that Grow* (Scott, 1949) suggests more activities than the other book. It deals, as you have guessed, with plant reproduction.

For the beginner's library add two books by Millicent Selsam. The first—and my favorite—is *Egg to Chick* (International, 1946) which clearly shows that chick embryology can be much more than Sophomore Zoology 16. No child should grow up without this book, a loaded incubator, or a setting hen. *Hidden Animals* (International, 1947) does a fine graphic presentation of protective coloration. Informational books on the physical world are lacking for the "minue six" age group. Vera Edelstat's *A Steam Shovel for Me* (Lippincott, 1933) set a good example. George Zaffo's *Big Book of Real Trains* and *Big Book of Real Fire Engines* (Grosset & Dunlap, 1949, 1950) are more than picture books for the young child. They get at the matter of how trains and fire engines work.

One Good Book Deserves A Series

If one good deed deserves another, then, as publishers see it, one good book deserves a series. The series that follows a promising book sometimes deteriorates rapidly. Just the opposite is the case for *The First Book* series (Franklin Watts) which gets better year by year. Beginning with *Automobiles, Trains, Flying,* and *Boats,* all by Campbell Tatham, the series gets off to an exciting start abetted by a simple, light, graphic presentation. Swinging into the animal kingdom, it continues with *The First Book of Bugs* by Margaret Williamson (1949) which, using a broad definition of bugs, lets the reader in on life histories of insects, spiders, and their kin. Latest in the series are *Horses* by McLennan McMeekin and *Dogs* by Gladys Taber (1949 and 1950). These three are certain to satisfy the older child and adult who wants to know about various breeds. My own series, published by Morrow, tends to mix understanding with simple activities. Included are *Rabbits* (1948), *Goldfish* (1949), *Homing Pigeons* (1949), *Snakes* (1949), *Frogs and Toads* (1950), and *Owls* (1950).

George Mason's wide experience afield and at the American Museum of Natural History has put its stamp in *Animal Tracks* (Morrow, 1947), *Animal Sounds* (Morrow, 1948), and *Animal Weapons* (Morrow, 1949). All these are functional pictures of activities and adaptations of animals from insects to mammals. Dorothy Hogner's *The Animal Book* and *Farm Animals* (Oxford, 1942, 1945) are complete enough to be classed as references, but so attractive they will keep you going after you've found the animal you were looking up. On about the same level are *The Gardener's First Year* and *Second Year* by Alfred Bates (Longmans, 1936, 1942). These guide the beginning gardener to annual and perennial plants.

Physical Sciences Offer Wide Variety

The physical science books for older children are so varied, and generally so satisfactory for both pupil and teachers, that we might as well jump in with both feet. Jeanne Bendick uses many delightful sketches to get across her points in *Electronics for Young People* (Whittlesey, 1947). The same technique makes *Television Works Like This* (Whittlesey, 1947) something that any elementary teacher can master. *Modern Radio* and *Telecasting and Color* by Kingdon Tyler (Harcourt, 1944, 1946) are more on the sober side, but full of up-to-the-minute facts and glimpses into the future. Of the many books on planes and aviation, a good stand-by is *How Planes Fly* by the Aviation Research Associates (Harper, 1943). By the same team, and of equal clarity, are *Parts of Planes, Type of Planes, Planes in Action,* and *How Planes Get There.*

In his *Picture Book of Molecules and Atoms* (Lathrop, 1947), Jerome Meyer presents a graphic and quite satisfactory introduction to neutrons, protons, and other sub-atomic particles, which might in other circumstances seem overbearing for the adult reader. George Russell Harrison's *Atoms in Action* (Morrow, 1949) goes further and gets into more about atomic energy. So does *You and Atomic Energy* by John Lewellen (Childrens Press, 1950). With teachers, parents, and pupils all interested in atomic energy, these books meet a need for simple explanations.

Minerals Provide Drama

For background stories of mineral products important in our daily life, try *Radium, Nickel, Asbestos, Aluminum,* and *Magnesium*—five books by Lilian Strack (Harper) which balance the scientific and the industrial story—all with excellent photographs. Nothing has quite equalled *Chemical Elements* by I. Nechaev (Coward-McCann, 1942) in the quietly dramatic story of how the elements were discovered and what those discoveries have meant.

Harrison's *How Things Work* (Morrow, 1941) still remains an old favorite. It's not to be confused with *How Things Work* by Creighton Peet (Henry Holt, 1941) which also does very well on

simpler explanations of levers, suction, friction, inertia, gyroscopes, pumps, thermometers, and the many other things we see and use daily. *What Makes the Wheels Go Round* by Edward Huey (Reynal & Hitchcock, 1940) goes further than the title implies and describes many physical forces and phenomena clearly and concisely.

A goodly number of books on the physical sciences for young people have developed a "how-to-do-it" aspect and succeed admirably in showing the youngster things to try and ways to experiment. But it is worth a passing comment to note that they almost universally neglect to warn the child about the importance of the know-how that comes from practice. A heap of juvenile frustration and educational blockage can be traced back to the things in the book that look so simple. With this warning in mind, children might have fun with *After-dinner Science,* Kenneth Swezey (Whittlesey House, 1948). Better still, and simpler, are *Fun With Chemistry* and *Fun With Science* by Mae and Ira Freeman (Random House, 1943, 1944). *Experiments Without Fire* tells of things to do with air, water, light, and sound; by Marian Baer (Rinehart, 1947). Two science teachers, Beeler and Branley, have joined forces to turn out a trio of well-planned and well-executed experiment books. Try *Experiments in Science, Experiments with Electricity,* and *More Experiments in Science,* (Crowell, 1947, 1949, 1950). *Let's Find Out* and *Now Try This* by Nina and Herman Schneider offer simpler experiences for younger children (Scott, 1949).

There are some excellent books on the earth and rocks, as Fenton's *Mountains,* (Doubleday, 1942), Coleman's *Volcanoes New and Old* (Day, 1946), and Henry Williams' *Stories in Rocks* (Holt, 1948), and some equally good on stars, trains, boats, and industrial applications of science—not to mention the lives of scientists themselves. Elementary teachers, librarians, and even parents owe it to themselves to be familiar with some of the things that Morgan, Hylander, Kane, Bethers, Schneider, and Pashko have written the past two or three years. However, in all fairness, this sampling should end where it began—with the child.

For the child interested in himself and how his body grows and functions, there is Baruch and Reiss' *My Body and How it Works* (Harper, 1934); still a fine elementary physiology. For those a bit older, Novikoff's *From Head to Foot* (International, 1946) is both informal and jampacked with facts. The latest, Schneider's *How Your Body Works* (Scott, 1949) stands up to its predecessors though omitting sex. With more emphasis on reproduction is Levine's valuable *A Baby is Born* which I prefer to his previous book for older children *The Wonder of Life* (Simon & Schuster, 1949, 1940). Both are well above average. My own *Mice, Men and Elephants* (Harcourt, 1942) focuses on man as a mammal with emphasis on mammalian intelligence and reproduction. Eva Evans shows children their social environment in *All About Us* (Capitol, 1947), a book which all teachers should read and use.

For those who would fill in the many gaps amid these brief selections, which, to this reviewer, seem to contain the rich milk, if not the cream, of science for juveniles, the reader need only refer to the *Bibliography of Books for Children* (Association for Childhood Education, 1949) and to a listing in James R. Newman's article on Children's Books in the December, 1949, issue of *Scientific American.*

Attention . . .

Researchers in Science Teaching

The U. S. Office of Education, in cooperation with the National Association for Research in Science Teaching, has developed a plan for collecting and publishing information about research studies on the teaching of science. The purpose is to supply leaders and research workers in science education with current information about completed research in the teaching of science. The plan calls for periodic reports on all masters' theses and doctoral dissertations which have been accepted, and for reports on faculty or other research studies which have been completed within specified periods of time.

Information is needed on research studies in the teaching of science, including applied science and technical training, at the elementary, secondary, and college levels. Further information on this project, and report forms, may be secured from Dr. Philip G. Johnson, specialist for science, Office of Education, Federal Security Agency, Washington 25. Cooperators will receive copies of the published report when it is ready.

Which Test Tubes Shall We Buy?

By WALTER S. LAPP

Teacher of Chemistry, Northeast High School, Philadelphia

THE first meeting of the Committee on Apparatus and Equipment of the National Science Teachers Association was held in Washington in December, 1948, at which time it was decided to undertake as our first project the relative long-range costs of borosilicate and sodaglass test tubes in chemistry laboratories of the high schools of the United States. Mr. M. W. Welch of W. M. Welch Manufacturing Company of Chicago, who attended the meeting by invitation, offered to supply the test tubes needed for the study and to underwrite the expenses of the project.

During the spring of 1949 detailed plans for the project were worked out by the committee. Fifty high schools which were to participate in the study were selected cooperatively by the committee and by the officers and directors of NSTA. During the summer of 1949 the Welch Company shipped 5555 borosilicate test tubes (No. 5628P, 150 × 18 mm.) and 5555 sodaglass test tubes (No. 5620, 6 × ¾ inches) to the 50 participating schools listed in the tabulation which accompanies this article.

In order to make the project as objective as possible, the following suggested directions and a form for reporting the results of the study accompanied each shipment of test tubes:

(a) The project begins September 1, 1949, and ends January 31, 1950.

(b) At the beginning of the term distribute an equal number of each type of test tube.

(c) Replace type for type. If a borosilicate tube is broken, replace it only with a borosilicate tube. If a sodaglass tube is broken, replace it only with sodaglass. If your supply of either type runs out before the end of the term, end the project in your school at that time. Note date on which this occurs. No additional tubes of either type will be supplied.

(d) Try to determine the cause by which tubes are lost.

(e) Keep your regular stock of tubes in a place not accessible to students.

(f) Do not discuss the project with students. Make the study as objective as possible.

(g) Do not use these tubes for teacher demonstrations.

(h) Any questions concerning the project should be sent to the chairman of the committee.

(i) Any tubes remaining at the end of the project are to be retained by the school.

(j) Mail your report to the chairman without fail February 1, 1950.

Of the 50 schools which received test tubes, 43 made a complete report, five made a partial report, and two failed to report even after three requests that they do so. The data collected are summarized as follows:

No.	Item	Borosilicate Tubes	Sodaglass Tubes
(1)	Number of tubes shipped by Welch to the 43 schools reporting	5027	5027
(2)	Number of students participating	2701	2701
(3)	Number of tubes broken in transit	19	71
(4)	Number of tubes lost, all causes	674	1358
(5)	Comparison of numbers lost	100	202
(6)	Cost of one tube*	$ .06	$ .04583
(7)	Cost of tubes in Item (5)	$6.00	$9.25

*See current Welch Catalog, pages 458 and 459

Teachers Comment on Tubes

Many of the participating teachers made interesting comments concerning the project and their observations. Illustrations of these are:

During the past few years we have used borosilicate test tubes for all experiments involving heating and are convinced that their use represents both

The original COMMITTEE ON APPARATUS AND EQUIPMENT of the National Science Teachers Association was appointed at the Cleveland meeting by Dr. Morris Meister (then president) in July, 1948. The need for such a committee arose from the occasional experiences of equipment manufacturers in finding that certain items which they offered were not acceptable by science teachers. In other words, there appears to be a need for an evaluation service in regards to science-teaching equipment and apparatus. In addition, this committee hopes to advance the discovery, invention, and development of new science-teaching materials.

Members of the committee include: Walter S. Lapp, Lansdale, Pennsylvania, chairman; Anna E. Burgess, Cleveland; Earl R. Glenn, Upper Montclair, New Jersey; Millard Harmon, Auburndale, Massachusetts; Norman R. D. Jones, St. Louis; Ralph W. Lefler, Lafayette, Indiana; Morris Meister, New York City; John G. Read, Boston; Gjertrude H. Smith, Pasadena, California; Wayne Taylor, Denton, Texas; and Elbert C. Weaver, Andover, Massachusetts.

HIGH SCHOOLS PARTICIPATING IN NSTA TEST TUBE PROJECT

Name of School	City	Chemistry Teacher in Charge
Alabama		
Murphy	Mobile	William H. Coffield
Arkansas		
Laura Conner	Augusta	Frank C. Zimmerman
California		
Glendale Union	Glendale	H. V. Anderson
Grossmont Union	Grossmont	Wilmer H. Brobst
Lemoore	Lemoore	F. Buckley
Loyola	Los Angeles	J. W. Johnson, S.J.
Jefferson	Los Angeles	W. A. Buck
Eagle Rock	Los Angeles	Olin B. Hart
Oakland	Oakland	W. B. Buckham
City College, Lower Div.	Pasadena	R. G. Bowlus
Connecticut		
Bulkeley	Hartford	E. H. Coburn
Illinois		
Community Unit 228	Geneseo	S. Fred Calhoun
Community	Normal	John C. Chiddix
Indiana		
Delphi Deer-Creek Twp.	Delphi	Charles E. Geheb
Elkhart	Elkhart	Ivan C. Gill
Monroe Township	Flora	Harold H. Thompson
West Side	West Lafayette	Mary Bushong
Maryland		
Catonsville	Catonsville	Virginia W. Duval
Massachusetts		
Abbot Academy	Andover	Eleanor M. Tucker
Phillips Academy	Andover	Elbert C. Weaver
Reading	Reading	Frederick J. Pope
Michigan		
Redford	Detroit	Dorothy Tryon
Missouri		
Kirkwood	Kirkwood	Elmer Headlee
Southwest	St. Louis	B. J. Chervenka
The Principia	St. Louis	Paul Brown
Christian Brothers College, Military High	St. Louis	Brother J. Edward, F.S.C.
New Jersey		
Rahway	Rahway	Fred J. Schmidt
Summit	Summit	W. S. Lukens
New York		
Boys	Brooklyn	Arthur Haut
Kenmore	Kenmore	Emerson Carl
Lockport	Lockport	T. J. Downey
Bronx, Science	New York	Herman M. Campsen, Jr.
William H. Taft	New York	A. H. Dick
Theodore Roosevelt	New York	Lester Newman
DeWitt Clinton	New York	A. Schwartz
Amherst Central	Synder	E. Petersen
Ohio		
West	Akron	Vernon S. Kulp
Stivers	Dayton	Walter Waggoner
Shaker Heights	Shaker Heights	Alfred S. Jones
Pennsylvania		
Lansdale	Lansdale	C. Richard Snyder
Northeast	Philadelphia	Leighton K. Smith
Souderton	Souderton	Martin I. Hulsizer
Stroudsburg	Stroudsburg	Joseph Kovarick
Tennessee		
Byars-Hall	Covington	J. E. Simonton
Highland Academy	Fountain Head	H. R. Lynd
Loretto	Loretto	J. Pechonick
Texas		
R. L. Paschal	Fort Worth	J. E. Benson
Ball	Galveston	Gretta Oppe
Mirabeau B. Lamar	Houston	William L. Burns
Virginia		
Norview	Norfolk	Franklin D. Kizer

an economy in cost and greater success in pupil experimentation.

—A. H. Dick, Chairman, Physical Science Department, William Howard Taft High School, Bronx, New York

The borosilicate tubes are very brittle, especially the lip, and extra care must be used to prevent bumping. The chemistry department in this school has now adopted the practice of using borosilicate test tubes for all teacher demonstrations. In all student experiments we know from many years of experience with the sodaglass tubes that at least half of all the test tubes given out will break during an experiment involving heating.

—Arthur Haut, Boys High School, Brooklyn, New York

I consider the borosilicate test tubes a much better buy, because of their ability to withstand the rough treatment given them by inexperienced pupils, and because they are much safer to use, as the bottom does not drop out easily, as in the sodaglass tubes.

—C. Richard Snyder, Lansdale High School, Lansdale, Pennsylvania

Discussion and Conclusion

In one school the project was completed on December 1, 1949, because all sodaglass tubes were consumed by that date.

In only seven of the 43 schools making a full report was the breakage of borosilicate tubes greater than that of the sodaglass tubes.

The main causes of breakage, listed in order of frequency, are improper heating, bumping, and dropping. Other causes included pouring cold water into hot tubes, improper clamping, and carelessness in cleaning. Teachers might place greater stress on instruction in proper methods of using test tubes.

A number of teachers observed that the breakage of borosilicate tubes consisted mostly of chipping and cracking of the rim. In this study all such tubes were considered as lost while, actually, many of them were still usable. Possibly the manufacturers of borosilicate tubes might make them with a heavier rim in order to reduce this defect.

According to this study, $6.00 worth of borosilicate test tubes are at least equal to $9.25 worth of sodaglass tubes. However, there are other considerations in addition to cost. The greater safety of the borosilicate tubes is bound to reduce the number of accidents in the chemistry laboratory. Their use will mean fewer burns due to the spilling of hot liquids and fewer cuts by jagged glass. Also there is a saving of the student's time by avoiding the necessity of repeating unfinished experiments due to breakage. Finally, there is also a saving of the teacher's time in not having to replace so many broken test tubes.

Assuming that the sampling of the high schools of the country has been fair, there is abundant evidence for the exclusive use of borosilicate test tubes in both student experiments and teacher demonstrations.

Acknowledgment: The Committee on Apparatus and Equipment of the NSTA is indebted to the W. M. Welch Manufacturing Company for supplying the test tubes and for paying the expenses of carrying out this project.

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Science Teachers
Join the Fight Against Cancer

By HARRINGTON WELLS

Associate Professor of Science Education, Santa Barbara College of the University of California

ABOUT 200,000 Americans will die of cancer during 1951. There is a very good chance (about one out of six) that you or I may die of it some day. Contrary to general belief, young people are not immune from this modern killer; indeed someone from *your* elementary school district may fall prey to this insidious disease during the current school year. Cancer ranks *third* nationally in the list of both male and female deaths from *all* causes, including accidents, for school children, ages one to 14, according to national figures prepared by the statistical and research section, Medical and Scientific Department, American Cancer Society. These figures include leukemia among cancerous death causes. Pneumonia figures, which place this disease second to accidents as a child killer, include influenza.[1]

It is true that cancer strikes most often at persons beyond middle age, for we know that heart disease and cancer cause most of the mature adult deaths in this country. This is due, in large part, however, to the remarkable advances in medical knowledge during the past half century which have led to control of other trouble-makers, such as yellow fever, smallpox, bubonic plague, tuberculosis, and diphtheria. Persons who attain middle age can, and have, had protective measures taken, through public health agencies and personnel, which steadily increase preventive and curative probabilities. The perils of malignant tumor growths are increasingly with us, however, and with our young people as they leave school and go out into the world.

Cancer, which has come into prominence during the last 50 years as a threat to human survival, is actually a very old disease in terms of medical recognition. It was known to the Egyptians at least 3000 years ago. The Greeks suffered and died from cancer. Hipprocates, the "Father of Medicine" and originator of the Hippocratic oath taken by our medical graduates today, gave it the Greek name which the Romans translated into the Latin *cancer,* meaning "crab." The name was indeed descriptive, for the malignant tumors infiltrate normal tissues, sending sharp-tipped appendages into them, twisting and tearing in claw-like fashion. Growth of tumors proceeds without control, invading and destroying mercilessly as cells divide by mitosis in rapid succession. It is the presence of great numbers of mitotic figures, as a matter of fact, which indicates malignant growth in the pathology laboratory.

The challenge is being met by science and scientists in two principal ways: through *research* and through *education.* Millions are being spent in grim attempts to ascertain the cause or causes of cancerous growths. Last summer the author personally inspected a completed installation of a million-volt X-ray machine designed to further deep therapy. Literally hundreds of the best minds

"Science Teachers Join the Fight Against Cancer," coming, as it does, at the start of a new school year, should prove helpful in preparing material to aid in teaching about cancer. It is also timely that this article should appear in the October issue of our journal in view of the recent NSTA free distribution to members of *The Challenge of Cancer.*

Written by Lester Grant, *The Challenge of Cancer* was prepared by the Federal Security Agency, National Institute of Health, Bethesda, Maryland. There is a teacher's guide to the use of the book, and an accompanying documentary film, *Challenge: Science Against Cancer,* has been produced by the official agencies of Canada and the United States. Orders for the book (55¢) and the teacher's guide (15¢) should be directed to the Superintendent of Documents, U. S. Government Printing Office, Washington 25. The film may be obtained on a loan basis from regional offices of the Public Health Service and the American Cancer Society, and from many regional educational film libraries. It may be rented for a small fee ($4.00) or purchased ($45.00) from International Film Bureau, 6 North Michigan Boulevard, Chicago 2. Inquiries should be sent to the National Cancer Institute, Public Health Service, Federal Security Agency, Washington 25.

[1] Mortality figures for children, ages one to 14, for 1947: all causes, 33,344; accidents, 10,731; pneumonia, 3240; cancer, 2490 (leukemia, 1185).

in physical biology and experimental physiology are searching with scientific exactness to find reliable methods of early diagnosis and cure. The pressing immediate need is for means of *recognition* of cancer *early* enough in its course of destruction to bring individual cases under control. Thousands of lives are being saved every year through early diagnosis followed by competent, thorough treatment, and much of present-day research is pointed at improvements in recognition techniques.

Education carries the message to the people, including medical men, and a dichotomous program of professional and lay education is being carried on in purposeful enlightenment of all those who treat the sick, by whatever methods, and of the rank and file of American citizens in the homes of the nation.

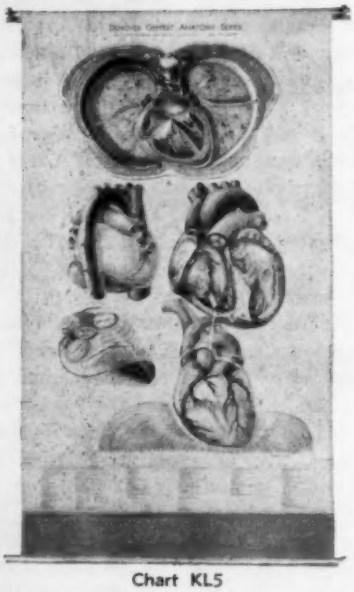
Here it is that the secondary school science teacher enters the picture—for it is through the schools that we shall reach the people. What shall we teach about cancer? Where (at what grade levels) shall we teach it? How may science educators obtain helpful assistance in the form of pamphlets, up-to-date information, and teaching aids? These are questions uppermost in the minds of professional people everywhere.

There are a great many important factors in the study of cancer, and, to a degree, choice of content material is at the discretion of the teacher. We know that cancerous cells are "normal" cells which grow wildly; sometimes quickly, sometimes slowly, producing abnormal, invading growth. Cancer spreads and if it has invaded the lymph or blood stream it may be carried to far parts of the body, there to lodge and begin new malignant growth. A malignant growth which proceeds unchecked in your "big toe" will kill you!

A tendency toward cancer seems heriditary; genetics is involved. Constant chemical or mechanical irritation may produce symptoms if hereditary factors are favorable, at least they do in mice. Generations of mice have been produced which are at birth doomed to die of cancer. Most of the experimental work is done with these rodents (although cancer is known in many animal forms) because of the mammalian relationship, coupled with availability, rapid breeding, and short life span.

What are the minimum essentials in cancer education? First, let us emphasize that *cancer is curable in the early stages.* Second, teach that there are no "quack" or patent medicine cures for can-

(*See* TEACHERS FIGHT CANCER, *page 145*)



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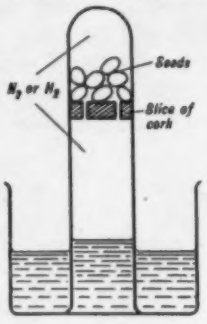
Demonstration Ideas from Overseas

To Show that Seeds Will Not Germinate in an Oxygen-Free Atmosphere

By MICHAEL T. CASEY, Newbridge College, Co. Kildare, Ireland

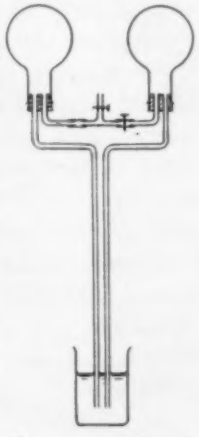
Some seeds are placed in a large test tube (6 × 1 inches). A cylindrical slice is cut from a cork which just fits the tube. Two holes are bored in the slice and it is then pushed down the tube to about two-thirds of its length. The tube is filled with water, and the seeds are allowed to soak for 24 hours. The tube still full of water is inverted in a large beaker of water, and some inert gas—hydrogen or preferably nitrogen—is passed into the tube. The seeds are now in an O-free atmosphere. The set-up may be placed in an incubator at 20° C. or in a warm cupboard. A control tube containing air is set up. After a few days the tubes are examined.



Sensitive Differential Air-Thermometer

By BERNARD G. KEDGE, St. Edmund's School, Canterbury, England

The apparatus illustrated seems much more satisfactory and sensitive for radiation demonstrations than the arrangement usually shown in textbooks. Two similar flasks, about 350-cc. capacity, are fitted with two-holed rubber bungs, 2-mm. tubing, T-tube, rubber junctions, and Mohr clips as shown. Colored liquid is sucked up, and both clips closed, ready for use.

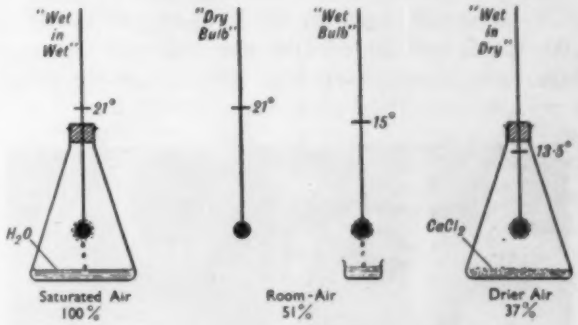


To show unequal absorption, a pair of flasks can quickly be coated as follows: cover each with a thin film of clear varnish. When almost dry, coat one with soot from burning candle; over the other sprinkle fine aluminum powder and rub lightly with cotton-wool (this gives a well-polished surface). A ½-kw. source of radiation, placed a foot or so away, produces marked difference in movement of liquid columns. "Recovery" rate is equally striking when source is removed.

Wet and Dry Bulb Temperatures

By J. F. SHILLITO, Buckhurst Hill County Grammar School, England

The following demonstrations can be set up without much trouble and serve to illustrate the working of the wet and dry bulb type of hygrometer. In addition to the usual thermometers with wet and dry bulbs, two others are required, both kept wet (muslin and/or cotton-wool) and corked in place in two conical flasks—one of these contains water and the other calcium chloride. Allowing sufficient time for equilibrium to be reached, the wet bulb in saturated air reads (as of course it should) the same as the dry bulb, so *wetness* is not the cause of lowered temperature as some of our pupils prefer to think. The wet bulb in the drier air is rather lower than the wet bulb in room air—the *dryness* of the air can be measured by the degree of lowering.



The experiments on this page have been reprinted with permission from The School Science Review, *Journal of the Science Masters' Association and the Association of Women Science Teachers of Great Britain.*

"Sensitive Differential Air-Thermometer" and "Wet and Dry Bulb Temperatures" are from Vol. XXXI, No. 114, March 1950; "To Show that Seeds Will Not Germinate in an Oxygen-Free Atmosphere" is from Vol. XXXI, No. 115, July, 1950.

It is interesting to note that over the past three or four years the names of approximately 150 British teachers have been on the NSTA membership roster—in contrast to only 15 U. S. members in the British association. I feel sure that this number will greatly increase if teachers in the U. S. see copies of School Science Review.

Membership in the Science Masters' Association and the Association of Women Science Teachers, including subscription to the magazine, is $2.50 for U. S. teachers. Applications for membership should be made on the appropriate proposal form, which can be obtained from NSTA headquarters.

—Robert H. Carleton, Editor.

Hi! Ho! Come to the Fair—

Opportunity for Nation's Junior Scientists

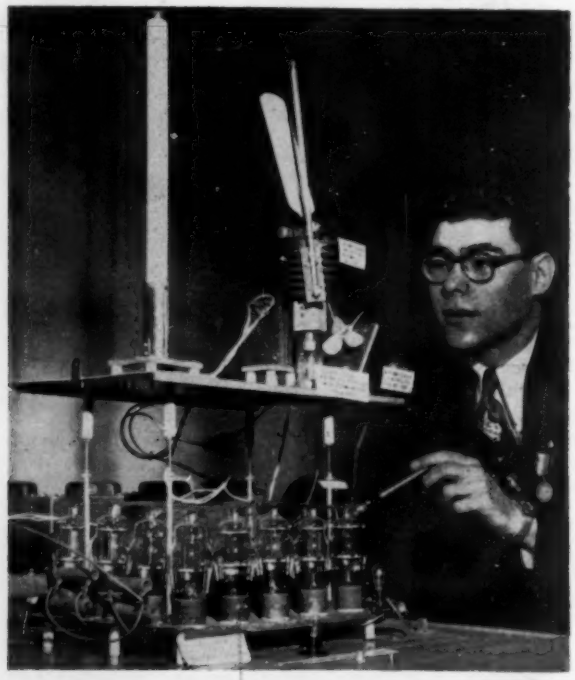
By Margaret E. Patterson

Science Clubs of America, Washington

THE old theme song, "Meet Me in St. Louis, Louis; Meet Me at the Fair," will be aired again when the second National Science Fair convenes in St. Louis, May 10–12, 1951.

Dozens of 'teen agers will gather on the campus of Washington University in the very area once occupied by the Exposition that made that tune popular in 1904. They will bring with them exhibits of their work in science to participate in the second showing of the recently launched National Science Fair, conducted by Science Clubs of America in cooperation with newspapers and educators throughout the United States.

If their work is anything like that of the boys and girls in the First National Science Fair at The Franklin Institute in Philadelphia in 1950, St. Louis will see a collection of science displays that will amaze even that science fair-conscious city.



David Kusner, 17, represented the Second Annual Greater Philadelphia Science Fair at the 1950 National Science Fair. Here he demonstrates his design to illustrate high frequency heating by induction.

The National Science Fair is a showcase—a miniature but comprehensive review of science. The showcase will travel. Each year it will be opened before a new audience with a completely new "cast of characters." Philadelphia saw it in 1950; St. Louis will see it in 1951; another city will play host in 1952.

Each National Science Fair will be the culmination of dozens of local science fairs held in large and small communities. Those chosen as finalists to the national will be the sophomores, juniors, or seniors whose exhibits typify the best products of the science fairs they represent.

Newspapers are making the National Science Fair dream come true for thousands of boys and girls, for educators and scientists, and for the public at large. Informing the public is the prime purpose of newspapers. Science today is a large area of information about which the public wants news. But, to many a newspaper reader, science is still something they assume to be a bit beyond their comprehension: a bit too smelly, too messy, or even too dangerous for the average person. Newspaper men reason this way: if our own hometown kids show us how exciting, interesting, and understandable science is, then it becomes a newsworthy and enjoyable way to keep up with fast-moving modern science.

Newspapers in widely scattered parts of the United States tried it this year. They held local science fairs, and the boys and girls flocked to them in beyond-expectation numbers—one fair had about 1600 entrants and needed a university field house to contain all the exhibits.

Many local science fairs have had to institute a system of eliminations in order to keep the number of exhibits within bounds of the local show place. They have encouraged each school to hold a tryout so all students can have an opportunity to participate. Teachers are finding this an excellent culminating event for the year's work on science projects. The best exhibits of the school then move on to the next elimination where the competition is, of course, stiffer. Some finalists at the First National Science Fair reported that they had

Frances A. White, 17, of Hyattsville, Maryland, represented the Fourth Annual Washington Science Fair at the 1950 National Science Fair. Her work on paper chromatography merited a first award.

"risen to the top" through as many as five eliminations.

For this entire venture, the newspapers arranged to pay the bills. Budgets ranged from a few hundreds to thousands of dollars, varying with the size of the city. Even those whose own enthusiasm caused them to exceed their budgets considered it money well spent.

It is expected that the 1951 National Science Fair will have finalists from many more local science fairs now that the pattern has been established. Newspapers pioneering this venture in 1950 were:

The Hartford Times, Hartford, Connecticut
The Washington Daily News, Washington
The Boston Daily Globe, Boston
The St. Louis Star-Times, St. Louis
Atlantic City Press, Atlantic City, New Jersey
Ocean County Leader, Point Pleasant, New Jersey
The Knickerbocker News, Albany, New York
Buffalo Evening News, Buffalo, New York
The Oneonta Star, Oneonta, New York
Oklahoma City Times, Oklahoma City
The Philadelphia Inquirer, Philadelphia
The Providence Journal, Providence, Rhode Island
Norfolk Ledger-Dispatch, Norfolk, Virginia

As important as financial and publicity support are, no newspaper would think of starting a local science fair without the wholehearted sanction of the scientists and science educators of the community. All guidance and planning of local science fairs must rest with committees of persons competent and experienced in dealing with young people and science.

These committees decide in advance what area is to be covered by the fair, who is to be admitted as entrants, rules and regulations for entrants and judging, size and kind of awards, and all the other items concerned with running such a program.

A gratifying result of working together on local science fairs has been the growing respect of educators for newspaper people and vice versa. For the first time, in some cases, these highly skilled groups have joined in a community venture, and they have learned to appreciate the good that comes from a pooling of effort.

It is the boys and girls that are the real winners when newspapers and educators join forces to give them the chance a local science fair provides.

The curiosity that is the essence of science comes early to most children, so some local science fairs are inviting even kindergarten and primary students to compete. Thus, all through the years, the child gets a chance to show his work, constantly bettering it as he has a chance to compare it with the progress of others. Even for those who do not go on into science as a profession, this early working with science will have a lasting effect on their attitude toward science.

For those boys and girls who show a lasting interest in science, the local science fair is their chance to meet others who know as much, or more, than they in their speciality—the science fair is their proving ground.

The National Science Fair is one part of the program that has been set up for young scientists by Science Clubs of America, administered by Science Service of Washington.

The whole program of Science Clubs of America is designed to popularize science among students and especially to assist those choosing science as a career. It was started in 1941 and, since that time, has grown until it is probably the largest science organization in the world. It is composed of about one-third of a million boys and girls in science clubs. Each club is sponsored by an adult—usually a science teacher. There are about 15,000 science clubs now affiliated here and abroad. Each sponsor receives the *Science Clubs of America Sponsor Handbook* issued annually.

Details of how to participate in the National Science Fair or any part of the program of Science Clubs of America will be furnished without charge from Science Clubs of America, 1719 N Street, N.W., Washington 6.

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Chats With Science Teachers—IX

By HANOR A. WEBB

Professor of Chemistry and Science Education,
George Peabody College for Teachers, Nashville, Tennessee

Speaking of Speeches

AN INARTICULATE science teacher? How could such a creature exist!

Can you talk with interest to an individual? The best speeches are conversational—not oratorical—in tone.

Can you talk instructively to a small class? Then you can instruct a large audience by somewhat better organization and a stronger voice.

Do you carefully plan your better lessons? Then you can plan a good speech. Do you find classroom teaching easier as you gain experience? Then you can become an experienced speaker by practice.

Some science teachers turn down invitations to speak in public, before adult groups. This is unfortunate, unprofessional, and unnecessary. If this Chat encourages a few timid speakers, prods some lazy ones, and commends a number of earnest commentators on science subjects, its publication will have been worth while.

The Speech

A good speech is like an insect. It has a head, a body, and a stinging end.

The head of your speech should be brief. Your beginning sentences may be a friendly return of the introducer's compliments, and a recognition of the purpose of the gathering. A quick and positive definition of your subject should follow, and a few clear statements as to why *this* subject should interest *this* audience.

A little humor may be injected anywhere in these few words. A clever phrase, or an exceedingly brief anecdote, will test the responsiveness of the audience. A bit of scientific humor may be used: "What would Newton have discovered if a coconut had fallen on his head instead of an apple?"

The head of your speech should contain no apologies, no effusive flattery, no "that-reminds-me" joke—related or unrelated to your subject. Avoid that first unhappy-audience question, "When will he ever begin?"

The subject you select should be interesting to you, interesting to your audience, suitable to the occasion, and fitting the time limit. You will know of the first quality. Determine the others by your best judgment, after getting all necessary information from your sponsor. The poorest subjects are those of which the audience knows little; the best subjects are those of which the audience already knows much. They will appreciate your new examples, new applications, and fresh organization you give the familiar topic.

The body of a speech that is most effective is a story. It should have aspects of human interest, in which actual events teach principles the audience will recognize as true and good. A series of shorter stories may comprise the full story.

And science is full of stories! Aristotle dissecting an elephant; Archimedes running naked through the streets; Galileo dropping light and heavy weights from the Leaning Tower; da Vinci constructing an airplane model; von Guericke hitching twice as many horses as he needed to his hemispheres; Pasteur vaccinating the unruly sheep; Edison singing "Mary had a little lamb" into the first phonograph. The list is almost endless!

The second-best speech is a sequence of a few related, and highly interesting, principles. They should be in words that can be remembered by all who are paying close attention. After each stated principle, a concise proof comes, with examples of its working and importance.

Just as the insect finds six legs enough, so the body of your speech should stand upon a few points. Six are enough—sometimes more are needed. You are not educating your audience by adding points—you are boring them.

Plan at least one anecdote or story-style example for each of the six (or fewer) sections of your speech. Some years ago my wife and I passed across a wide New England stream on a sturdy bridge—itself a veteran of many winters. But there had been a far older bridge, now wholly washed away except for battered piers, erected about the time Portland cement was invented. As we inquired during a brief stop at the nearby village, no one remembered the form—covered or uncovered—of the early structure. But the concrete piers were quickly called to mind by all. So with your best speech; you will meet persons a decade hence who

remember your specific stories, as they recall the speech to you. The higher philosophies you offered may have been washed from their memories. So what you want remembered, make concrete!

The "stinging end" of your speech should be as carefully prepared as its beginning. Know exactly what strong, brief urge shall be your "call for mourners." Plan—and use—that "punch line" which will bring applause as you sit down. Come to this climax promptly; avoid that second unhappy-audience question, "When will he ever stop?"

Every truly significant speech does have an urge at the end. If your audience consists of parents, urge them to approve and encourage their children in experiments, even if the household order is upset. If you speak to students, fire their ambition by an urge to be "the man who knows!"—and point the way. If you address fellow teachers, urge a new alertness in this rapidly changing world. Build up these advices in the body of your speech, then—at the very end—offer the heart of the matter in "words that bless and burn!"

If this seems a bit out of your line, at least you can make a single earnest proposition of your points, and cry out, "This I steadfastly believe—do you?"

Many a speech ends gracefully on a quoted poem, which of course should be an obvious climax to the talk. Certain speeches can well be ended by the best anecdote of the lot, but the moral must be clearly expressed, and not left to any guesses by the audience. No matter what the actual words may be, every superior speech has the listeners holding their breath at the very end!

The Speaker

It takes a speaker to make a speech. Trite idea, indeed! The point is, however, that a good speaker can impress an audience with a poor speech, while a poor speaker can blight the best of speeches. The content of a speech is one thing, and its delivery something else indeed! It is to be hoped that *your* speeches are good in both respects.

You must decide for each important speech whether you will speak with or without written aids to memory. A manuscript is required for a "paper" before a learned society, since often it is to be published. Notes are appropriate for important addresses on single occasions; these should be on small cards little larger than your palm, rather than on sheets of writing paper. Even though you refer to them seldom, they assure the

(*See* CHATS WITH SCIENCE TEACHERS, *page 144*)

WATER AND MAN

A Study in Ecology

WATER AND MAN is the invaluable record of what was said when nearly a score of top-flight authorities on the subject of water and its relation to Man's life and work upon this Planet, were brought from all parts of the country by Friends of the Land, to address their Eighth Annual Conference on Conservation, Nutrition and Health.

Paul B. Sears, Department of Conservation, Yale University, in his foreword to WATER AND MAN, refers to the "all star cast" of contributors. Jonathan Forman, M.D. and Ollie E. Fink have compiled, annotated and edited these papers and selections into a book of approximately 450 pages, well illustrated.

Teachers will find this book a source of invaluable information about water, its management, and the vital part it plays in the life and environment of man. The rapid depletion of water resources in many areas makes it imperative that teachers be well-informed and capable of relaying such information to their classes.

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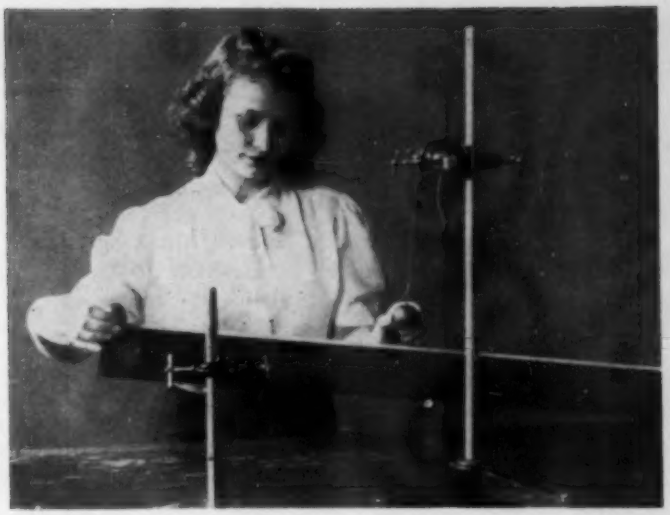
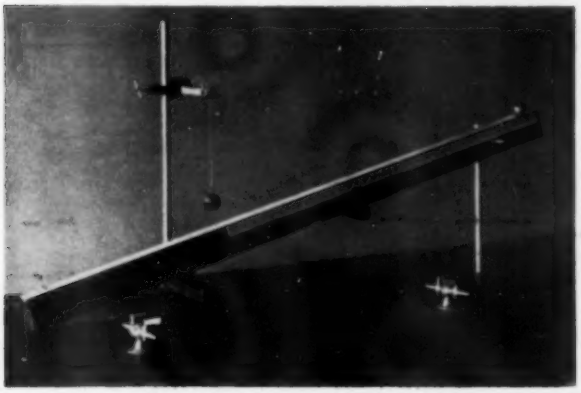
Accelerated *Motion*



By H. CLYDE KRENERICK
Milwaukee, Wisconsin

SIMPLE and low-cost apparatus for experiments on accelerated motion can be made from two pieces of wood $1 \times 3 \times 60$ inches. The pieces are slightly beveled on one edge and then clamped together, forming a rigid plank $2 \times 3 \times 60$ inches with a shallow groove in one edge. The pendulum suspended near the side of the plank makes a complete vibration in one second. The operation is so simple and direct that the experiment for deriving the laws of accelerated motion can be performed, and its record completed, in a 45-minute laboratory period.



The pendulum is so placed and adjusted that the bob, when at the end of a 16-cm. arc, is in contact with a ball placed in the groove. The operation is to hold the bob in this position and place the ball at some position up the incline. The bob and the ball are now released at the same instant. This can be done with considerable accuracy as it is the same movement of finger and thumb on each hand.

If the ball and the bob just click in passing, the distance the ball rolls during the first second has been obtained. To find the distance the ball rolls during the first two seconds, move the pendulum down near the end of the plank and have the ball and bob strike at the end of the second complete vibration. From the distance passed over during the first second and the distance passed over during the second second the acceleration may be obtained. The student then discovers the relation between the total distance, the time, and the acceleration. He derives the formula for distance in terms of acceleration and time.

This form of acceleration apparatus may be used in three more interesting and instructive experiments. By varying the height of the incline, different forces and their accelerations may be compared (Newton's Second Law of Motion). In a previous experiment on the resolution of forces, the component of gravity causing an object to roll down an incline may have been determined. Here that force may be measured in both gravitational and absolute units. This is a most desirable experiment in teaching absolute units. In a fourth experiment, the relation between the potential energy of the ball when it starts to roll at the top of the incline and the kinetic energy it has when it strikes the table may be determined.

The author has experimented for thirty years on laboratory methods and equipment in an effort to design sufficiently simple and inexpensive apparatus so that all schools could have some laboratory work and, in most cases, could have duplicate or multiple sets of apparatus.

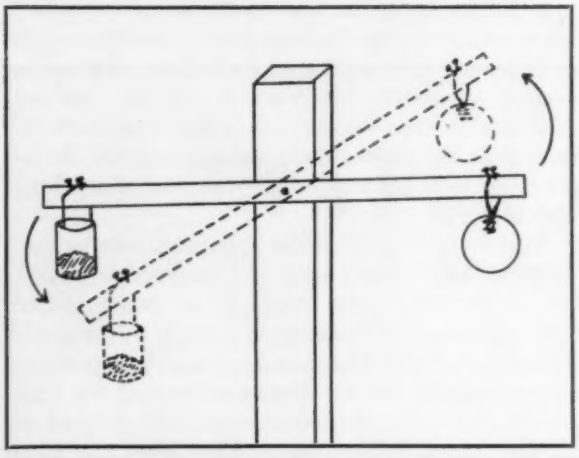
Small Fry Can Show That Air Has Weight

By GUY V. BRUCE

Professor of Science, New Jersey State Teachers College, Newark

How much air does an eight-year-old think he can lift? He may think he can lift a whole room full; or most likely he thinks that air has no weight at all. This experiment presents a method of demonstrating that air does weigh something, and it can be easily performed by eight-year-olds.

To construct a simple balance for this purpose, drill a small hole through the center of a light wooden rod about five feet long. Put a nail through this and drive the nail into any upright wooden support as illustrated. Be sure that the rod turns very easily on the nail. It must not be allowed to rub against the upright support. Hang a small pail on one end of the rod. Fasten it into position with two thumb tacks; one on either side of the handle of the pail. Borrow a basketball and a pump from the physical director. Fully inflate the ball. Tie a loop of string into the lacings of the ball and by this hang it to the other end of the rod, using thumb tacks to hold it in place.



Pour sand into the pail until it balances the ball accurately. It may be necessary to remove and add sand several times before it is well balanced. Now let the air out of the ball. The pail will drop on the balance showing that air does have weight.

To discover how much weight the ball lost when it was deflated remove sand from the pail until a balance is once again achieved. Weigh the sand that has been removed.

This may be as far as teachers of the lower elementary grades will wish to carry the experiment. At higher levels it can be expanded by adding arithmetic. Have the class look up in a textbook the weight of a cubic foot of air at the temperature of the room; find the number of cubic feet in the room, and work out how much the room full of air weighs.

Now available from NSTA headquarters are the first two volumes in the new "Science Teaching Today" series. Recognizing the need for practical science teaching aids for the elementary and junior high school grades, Vol. I, *Experiments With Water*, and Vol. II, *Experiments With Air*, by Professor Bruce are geared to these levels.

"Small Fry Can Show That Air Has Weight" is adapted from one of the 62 student experiments and teacher demonstrations included in the new books. These volumes may be ordered as a pair for $1.00 or singly for 50 cents (with discounts on quantity orders) from the National Science Teachers Association, 1201 Sixteenth Street, N.W., Washington 6.

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Joseph Priestley

By GORTON R. FONDA
General Electric Research Laboratory (Retired)

We are pleased to reprint this talk which was delivered on February 22, 1950, during the General Electric SCIENCE FORUM program—a weekly broadcast on Wednesdays from Schenectady, New York, over Station WGY at 7:30 p.m. Teachers of general science, biology, and chemistry, as well as those experimenting with the "case study" approach, may find ways to use this article.—*Editor.*

THE NATURE of chemistry is such that it has developed as a science in an atmosphere of romance. Its reactions are so spectacular that even those who are untrained are enticed to experiment with them. Occasionally such untrained persons have made notable discoveries. The Englishman, Joseph Priestley, was one of them. He lived about 150 years ago. His most important discoveries were made just before the American Revolution: the discovery of oxygen as an elemental gas, the discovery that air is a mixture of oxygen and nitrogen, and that water is formed by the combination of oxygen and hydrogen. Simple as these discoveries appear to us today, they were unexpected at the time and of the greatest importance. They offered the solution to the outstanding problem of that age, the nature of combustion and oxidation. In the hands of another man, a professional scientist, they became the keystone needed for the completion of that arch of knowledge upon which the structure of modern chemistry has been based.

The son of simple country folk, Priestley had been fortunate enough to receive an education whose breadth of culture was characteristic of the elite of the eighteenth century, and still more fortunate to have been trained in the art of controversy and inquiry. He was educated for the ministry and he became an active figure in the church as preacher, teacher and writer. He was a radical thinker. Originally a dissenting Calvinist, he revolted from their ranks to become a Unitarian.

Before entering actively in the ministry, he spent six years on the staff of an Academy, teaching Latin, Green, French, and Italian, and lecturing on logic, history, civil law, politics, and anatomy. To round this out, he guided the students in conducting laboratory experiments in science. The more significant experiments were occasionally repeated in the evening for the benefit of older people as a means of awakening a broader interest in science. It was at this time that he and Benjamin Franklin formed a friendship that lasted throughout their lives. Under Franklin's encouragement and assistance, he wrote a *History of Electricity,* combining what was known at the time with results of his own experiments on features which he considered questionable.

Almost all the rest of his life was spent in the ministry, but always under such conditions that his enthusiasm for scientific experimentation might be gratified. The kitchen was his laboratory and its utensils were his apparatus. The rest was supplied more by his ingenuity, which was large, than by his purse, which was small.

His particular field was the generation and identification of gases and the investigation of their properties. His original method of collecting them over mercury as well as over water allowed him to discover and to investigate those which had been missed by others because of their solubility in water, such as ammonia, sulfur dioxide, hydrochloric acid gas, and silicon tetrafluoride.

In his experiments with carbon dioxide, he devised the first practical process for obtaining a highly charged solution of it in water, becoming thereby the proud father of pop beverages. The government built extensive apparatus in order that Dr. Priestley's soda water might be made available for His Majesty's Marine.

He investigated the process of combustion and discovered how the poisonous gas, carbon monoxide, is formed.

Among his other discoveries were the oxides of nitrogen. They included nitrous oxide, which soon became famous as an anesthetic in dentistry under the name, "laughing gas," and nitric oxide. He developed the latter as a satisfactory reagent for measuring the oxygen content of air.

His discovery of oxygen in 1774 was in fact his outstanding contribution to science. "This discovery," he says, "furnishes a striking illustration that more is owing to what we call chance, that is, to the observation of events arising from unknown causes, than to any proper design or preconceived theory." He had obtained a large convex lens or burning glass, as it was called, and was curious to try the effect of heating different

(*See* JOSEPH PRIESTLEY, *page 152*)

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In Lieu of an Editorial—

The National Science Teachers Association acquires *The Science Teacher* at an auspicious moment in the development of the field especially served by the organization. Human knowledge of the phenomena of matter and skill in applying it have both vastly expanded in the present generation. There is every reason to believe that the progress of the decades ahead will greatly exceed that of centuries immediately behind us. Man stands on the threshold of scientific achievement never before envisioned in his most fantastic dreams.

In this dramatic advance, the science teacher is cast in a leading role. The talent of tomorrow is in our schools today. To discover and develop it is an obligation and a satisfying task. The magazine which the association launches as its own project with this issue can, and I am certain it will, aid the science teachers to make a significant contribution to human progress.

The Science Teacher is in a position to make an additional contribution perhaps more effectively than any other medium. Our mastery of science threatens to master us. Knowledge and ignorance both have the potential to destroy. The teacher sees clearly that knowledge contributes to human welfare only as it is properly evaluated, directed, and controlled. It is a responsibility and privilege of your publication not only to keep teachers abreast of the advancing front of science, but also to keep them aware of the impact science makes upon the spiritual and moral values that are supremely significant for the happiness of mankind.

WILLARD E. GIVENS
Executive Secretary,
National Education
Association

With this issue *The Science Teacher* enters a new epoch in its history, for it is now under the direct editorial management of the National Science Teachers Association. The association may rightly feel the pride of ownership, but the feeling must inevitably be mixed with a deep sense of responsbility, akin to that of parents who have just brought a new life into the world, and who must watch and guide it through successive stages of physical growth, mental training, and moral responsibility.

For several decades science has enjoyed a healthy physical and intellectual growth, but it is only partly aware of the character and magnitude of its moral responsibilities to society. A new generation of scientists must acquire full consciousness of its obligations to mankind, and a new generation of students in every field must grasp the integration of science with the well-being of the human race. Who teaches the new generation assumes an important and grave obligation. Who teaches the teacher performs a critical and vital function.

The Science Teacher must assay leadership in this direction, however humbly it may start. Its management is where it should be—in the hands of teachers, who must ever learn if they are to teach. On behalf of the American Association for the Advancement of Science it is a privilege to wish an affiliate all success in this new publishing venture and to express confidence that the job will be well done.

HOWARD A. MEYERHOFF
Administrative Secretary,
American Association for the
Advancement of Science

The meaning of science in our world of today far transcends a mere cataloging of the splendid achievements of our scientists and the practical applications of their findings. Science in a few generations has transformed our way of life, has shrunk the world to small compass, and has drawn impelling attention to the need for new understandings of man's relations to man.

Our schools and colleges must accept the challenge of these meanings. Their task is to transmit our heritage of scientific knowledge and to expand its frontiers, to train our future scientists, and to teach the meaning of science and its impact upon our society.

It is my sincere belief that through the new medium of *The Science Teacher,* the National Science Teachers Association will be giving new impetus and inspiration to teachers in schools across the nation—that new thought and action will be stimulated to help lift the standard of science teaching at every educational level.

EARL J. McGRATH
United States Commissioner
of Education

*To be published soon**

BASIC SCIENCE

A NEW TEXTBOOK IN GENERAL SCIENCE

By

J. DARRELL BARNARD
Professor of Education
School of Education
New York University

and

LON EDWARDS
Chairman, Science Department
State Teachers College
Danbury, Connecticut

TEACHERS OF GENERAL SCIENCE have longwaited a textbook that supplies details essential to an understanding of primary scientific principles. *Basic Science* satisfies this need readably, stimulatingly, and practically. This new textbook in general science features:

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* *For early 1951 publication. Watch for announcement.*

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Meetings and Conferences

Looking Back—to St. Louis

"Interesting, but not exciting," was the typical comment of Board of Director members of the National Science Teachers Association after three business sessions in the Hotel De Soto, St. Louis, July 1 and 2, 1950. Although NSTA still has many problems, its officers and directors are working smoothly along lines of policy that have been the subject of past debates and firm decisions.

Nathan A. Neal, president of NSTA, was in the chair at all meetings. Near him were Robert H. Carleton, executive secretary; Ralph W. Lefler, president-elect; Elbert C. Weaver, treasurer; and Hanor A. Webb, recording secretary.

Carleton introduced two visiting science teachers from Europe: Mrs. Lucy V. Fyta, Teacher Training College, Athens, Greece, and Mr. Agvald Gjelsvik, principal of an elementary school in Vinstra, Norway. Both have been traveling throughout this country under grants in aid to study science teaching methods.

Carleton reported an increasing membership, the net addition to the rolls of NSTA being 964 for the year. Total paid membership in June, 1950, was 5315. A new "school membership" was described, in which about 40 elementary schools have taken out memberships in the name of the school, for the use of all teachers.

NSTA services to members will be increased with the six issues per year of *The Science Teacher* in new size and format; and in the publication of items in a series, "Science Teaching Today." Announced for fall publication are *Experiments with Air* and *Experiments with Water,* two practical booklets at moderate cost designed for use with upper elementary and junior high classes.

The Packet Service, however, presents a dilemma since it has operated at a deficit during the year. The directors discussed various plans to make this valued service pay its way.

Weaver presented a detailed report, showing a deficit in the general services account of $164.31, a deficit in the packet account of $4849.90, and a balance in the Industry-Science Teaching Relations Advisory Council of $4316.57; an overall deficit of $697.64. The directors discussed these figures earnestly, and concluded that the new schedule of dues, plus a continuing membership gain, would bring the income and the expenses of the organization into a satisfactory relationship.

Policies for future meetings of NSTA interested the directors. It is hoped to work out practical plans for regional meetings of the association, thus giving as many members as possible an opportunity to attend.

—Summary prepared by HANOR A. WEBB, *Recording Secretary.*

Looking Ahead—to Cleveland

The 1950 winter conference of NSTA will again take place in conjunction with the annual meeting of the AAAS. Sessions will be held December 27 through 30 in the Hotel Statler, Cleveland. For the third year in a row, other science teaching societies of the AAAS will participate in the joint conference. The National Association of Biology Teachers and the American Nature Study Society have worked with NSTA in developing this year's conference.

Focus of attention during the four-day conference will be "Resources for Learning Science." Outdoor resources the 27th, human resources the 28th, and industrial and technological resources the 29th will pin-point discussion at general and individual sessions of the several societies.

The NSTA Advisory Council on Industry-Science Teaching Relations will conduct its fourth national conference the afternoon of Friday, December 29. In the afternoon of December 30, there will be a conference on the National Science Foundation. It is hoped the new director will take part.

An "all-societies mixer" in the Grand Ballroom the night of December 27 will insure that the conference is not all work and no play. Exhibits will be on display Wednesday through Friday afternoon.

Registration with AAAS is strongly encouraged —$2.00 for AAAS members, spouses, and *bona fide* students; $3.00 for others. This will not only help AAAS and its affiliated societies (including NSTA) to put on the annual meeting, but will entitle the registrant to many special features: the science exposition arranged by principal publishers and scientific companies; the science

(*See* MEETINGS, *page 147*)

Clip 'n Mail

AT YOUR SERVICE. . . . This "coupon service" page announces the availability of free and low-cost business-sponsored teaching aids for science, all of which have been reviewed and approved by the NSTA Evaluation Committee for the Packet Service. To procure copies of desired items, fill out the corresponding coupons and mail these, together with any remittance required, to the NSTA Executive Secretary, 1201 Sixteenth Street, N.W., Washington 6. Watch these columns for additional offerings in future issues of *The Science Teacher.* (Print or type coupons.)

MEDICAL USES OF BLOOD—A MANUAL FOR SECONDARY SCHOOL TEACHERS. *American National Red Cross.* The report of a committee of the American Association for Health, Physical Education, and Recreation. Contains questions and answers on the composition and functions of blood and procurement and uses of blood as a medicine. Also includes suggested student activities, suggested integrations, a brief quiz, and a list of resource materials.

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Books in Review

ACTION—AND REACTION

In the spring of this year two books appeared which, because of the sensational nature of their interpretations of science and history, have received far more attention than is awarded the usual run of books. They tend to place science in a light that the layman will misinterpret. Science teachers, especially in high schools, are likely to have to answer these two books. We are pleased to offer some help in the form of critical reviews reprinted here by courtesy of the journals in which they first appeared.—*Editor.*

Worlds in Collision. Immanuel Velikovsky. 401 pp. $5. The Macmillan Company, 1st pub.; Doubleday and Company, 2nd pub. New York. 1950.

It is difficult to condemn a man who is obviously seeking the truth, though you think him to be as wrong as wrong can be. But when the truth-seeker goes to the public for approval of his ideas before he submits his viewpoints to men expert in his field for the ruthless criticism and cross-checking that is the very life-blood of science, abstinence from condemnation becomes difficult. . . . The fact that what he says makes little sense is not important. The fact that many persons not versed in science are now hailing Dr. Velikovsky as the twentieth-century Newton *is* important. . . . Had I the energy I might have written a letter to him outlining, from the point of view of the physical sciences, the errors both in fact and theory which I believe he has committed. However, such a letter would have been at least 30 pages in length, a fact which in itself explains my reasons for not writing it.

. . . Briefly, his thesis is that a comet passed near the earth on two occasions (once about 1500 B.C. and again about 1450 B.C.). This comet had its origin in the planet Jupiter and after messing things up in the solar system ended up as the planet Venus. During the messing-up period the comet temporarily stopped the earth from rotating (the miracle of Joshua). Other effects and aftereffects of the comet explain, according to Dr. Velikovsky, various effects such as the "raining of blood," the "hail of stones," "the raining of naphtha," . . . etc. But that is not all . . . it is difficult to think of a major earthly phenomenon—from glacial activity to the origins of religion—that is not touched by Dr. Velikovsky's thesis.

. . . But we do not require Dr. Velikovsky's comet to understand these phenomena. The combination of modern astronomy, geophysics, paleontology, geology, and physics can state the following:

The earth did not stop rotating 3500 years ago.

Venus was formed much earlier than 3500 years ago. Indeed, it is probably about a million times older than Dr. Velikovsky suggests.

Venus was not formed from a comet emanating from Jupiter (or, for that matter, a comet emanating from anything else).

Modern science can say all of the above (which represents the heart of Velikovsky's conclusions) and it can marshal far more convincing evidence—evidence which possesses mathematical rigor as distinct from interpretations of interpretations of what human beings may or may not have done, observed, or said thousands of years ago.

. . . I do not object to the publication of this book—or for that matter any book. But the reader may rightly be offended, as was this reviewer, by the irresponsible publicity, including magazine articles, which preceded publication as part of the build-up. . . . The book was launched by a wind which bodes good only to those on the receiving end of the cash line. Ten years from now it will probably be forgotten by all except those unfortunate scientists who will have had to answer questions about the book in every public lecture.

HARRISON BROWN
University of Chicago
Excerpted with permission from
THE SATURDAY REVIEW OF LITERATURE
Vol. XXXIII, No. 16, April 22, 1950.

Science Is a Sacred Cow. Anthony Standen. 221 pp. $2.75. E. P. Dutton. New York. 1950.

A sprightliness of style, a few well-put and well-deserved cracks at the pompous and the fradulent, and a fundamentally vulgar line of thinking make this book a minor success of the day. Mr. Standen, chemist and jacket-claimed humanist, discusses the five great branches of science, pays homage to mathematics and the platonic ideals, and ends by urging the reader to watch scientists carefully against their putative lust for political power. He even draws a laugh out of the matter, for he is no sobersides.

. . . The technique is simple. He recalls the most obvious prejudices of the chuckling reader. He avoids the great or the difficult like the plaque. . . . His arguments appeal to the least reflective, and gloss over everything that might tend to show where the real problems lie. For example . . . Mr. Standen seriously illustrates the meaning of scientific method by pointing out that if one gets tight on whiskey and soda, brandy and soda, and gin and soda, the scientific conclusion is that the common factor, soda water, is the responsible substance.

. . . The example cited is by no means unusual. The whole of the book has the same amused and insincere tone. . . . It is too bad that the good and great men, the fascination and the wonder, the sheer human joys and sorrows that every scientist knows in his science and in its history were ignored. That

science can illumine a way of life is lost in this rush of cleverness. . . . Though he (Mr. Standen) speaks many a true word, as he himself gently implies, in jest, the book in sum is a patchwork of facile half-truths and cheap victories.

PHILIP MORRISON
Cornell University
Excerpted with permission from
SCIENCE, Vol. III, June 9, 1950.

Modern Science Teaching. Elwood D. Heiss, Ellsworth S. Obourn, Charles W. Hoffman. 462 pp. Illus. $4.50. The Macmillan Company. New York. 1950.

According to the authors, "The purpose of this book is twofold: (1) to serve as a textbook for those courses in methods of teaching science which are now being given in many colleges and universities; (2) to serve as a source book for teachers of science, supervisors of science, and science educators, at whatever level they may be working who wish to keep abreast of present trends in the teaching of science." In the judgement of this reviewer, this twofold purpose has been effectively achieved.

The first part of the book stresses the need for science teachers to develop a philosophy of science teaching. The authors point out that "there seems to be a reasonable agreement among those concerned with formulating the general goals toward which education should be directed, that it should function to modify the behavior patterns of the individual in such a way as to make his adjustment to the problems more effective and more satisfying." One might say that it is easy to make such statements, but that, in order for such a philosophy to become a part of the action program of the teacher instead of just a "set of paper goals," the teacher must become convinced of its value and must be given specific help in carrying it out. The remainder of the book does just that.

This book will help teachers toward answers to questions such as these. What are some of the characteristics of children in the elementary school? in the junior high school? in the senior high school? How should the content for the general science course be selected? for the biology course? for the chemistry course? for the physics course? How should the learning materials in science be organized? If problem-solving is to become a vital part of the program, how can the teacher become more effective in this kind of science teaching?

As the goals of science teaching have changed, so have the purposes and methods of evaluation changed. In the past, mastery of content was the chief index of pupil achievement; now there is an attempt to evaluate such things as growth in the abilities and skills in scientific problem solving and changes in attitudes and behaviors. The usual type of teacher-made tests will not suffice for this type of evaluation, and many aspects of it are discussed here. With the information given, the interested teacher should be able to develop new and better types of achievement tests.

What type of room or rooms shall we have for the science department? What kind of furniture and equipment shall be placed in the science room? These are questions which face the administrator and the science teacher. In the second section of this book the authors suggest answers to these questions and many others. There are numerous illustrations and photographs of various arrangements.

The remaining chapters of the book give detailed information on various sensory aids that can be used by teachers to help their students derive the proper learning experiences. If one has the problem of planning a school journey, a study of pages 292–300 will furnish helpful information. If the teacher wishes to know what type of camera to purchase, what kinds of filters are available, details on different kinds of emulsions, how to develop a negative, the technique of printing and enlarging, he can find this information here. And so with other practical problems of teaching science.

For the young and inexperienced person just entering the field of science instruction, there should be available material which would be of help in the planning of the work. For the experienced science teacher there should be materials that would be of help in making the lesson more effective and meaningful to the pupils. This book will furnish much of the desired information.

HENRY A. SHANNON
North Carolina State Department of Public Instruction

Frogs and Toads. Herbert S. Zim. 64 pp. Illus. $2.00. William Morrow and Company, Inc. New York. 1950.

Frogs and Toads is another in a series of books by Dr. Herbert S. Zim dealing with animals of particular interest to younger children. Written in simple language and printed in large clear type, the text tells about the life of these amphibians in general and manages to answer questions as they occur to the reader. Starting with the emergence of these creatures as the first vertebrates upon the land, Dr. Zim goes on to distinguish between amphibians and other animals and between the tailed and tailless amphibians. Information, simply and interestingly presented, tells of the distribution, characteristics, reproduction and development, structure, locomotion, food habits, hibernation, friends and enemies, and practically every aspect of the lives of these animals.

The drawings by Joy Buba are in black and white and do much to make this slim volume of interest to a wide age group. The drawings and text complement each other perfectly. This is a book which might well be placed on the nature bookshelf, whether in a library or in an elementary or secondary schoolroom.

CLARE F. SMITH
Washington, D. C., Public Schools

A Course in General Chemistry. Third Edition. *Semi-Micro Alternate Form.* William C. Bray, Wendell M. Latimer, Richard E. Powell. 217 pp. Illus. $3.00. The Macmillan Company. New York. 1949.

For college chemistry teachers who adhere to "principles," as distinguished from "descriptive" chemistry, this freshman laboratory manual is a recognized classic. The latest revision, adopting semi-micro procedures for the second semester's work, was overdue. Normally, this book will be considered for use only in conjunction with the well-known texts to which it is keyed: Hildebrand's *Principles of Chemistry* and Latimer and Hildebrand's *Reference Book of Inorganic Chemistry;* for this purpose it is an eminently suitable laboratory manual.

Many chemistry teachers are reluctant to assume that their beginning students have sufficient chemical maturity to pursue such texts effectively, even though the desirability of the "principles" course is admitted. The authors of *A Course in General Chemistry* aver that "high school chemistry is not necessarily a prerequisite." They then add some qualifying remarks showing that they are conscious of the difficulty of teaching principles in an informational vacuum.

Experiments covering the first five weeks as prescribed by this manual are semi-quantitative, often requiring the students to make weighings to 5 mg. The remainder of the first semester is devoted to the general principles of ionic equilibria. Assignments for the second semester involve the study of specific ions in aqueous solution and some well-chosen representative work in qualitative analysis. In view of the relatively advanced treatment of other topics and of the attention paid to hydrogen ion concentration, it seems odd that pH is never mentioned.

The questions and problems included with the experiments are good, and the more liberal use of drawings in this edition is an attractive feature.

FORREST BLANKENSHIP
The University of Oklahoma

How Your Body Works. Herman and Nina Schneider. 160 pp. Illus. $2.50. William R. Scott, Inc. New York. 1949.

How Your Body Works answers a long-felt need for a new physiology for young folks. The authors write directly to the child, leading him through fascinating, easy experiments and appealing discussion into a better understanding of the normal functioning of the systems of his body. To illustrate the type of experiment used, the one entitled "Why Two Eyes?" from pages 109–110 is quoted:

> Why do you have two eyes? Here's an experiment that will show you why two eyes are better than one.
>
> You Will Need: yourself and a fountain pen.
>
> Try This: Hold the cap of the pen in one hand. Hold the rest of the fountain pen, point up, in the other hand with your arm stretched almost straight out. Close one eye. Try to put the cap on the pen in one quick movement. What happens? Try again.
>
> You Will Find: that sometimes you will bring the cap too near and sometimes too far. It's hard to judge distance with one eye.
>
> Now try the experiment with both eyes open. You won't have any trouble capping the pen.
>
> This Shows: that it is easier to judge distance with two eyes.

An indication of the direct approach to the child may be shown by such chapter headings as "You Own a Wonderful Machine," an introduction by Milton I. Levine, M.D.; "What Your Body is Made of"; "Food Keeps You Growing"; "Food Keeps You Warm"; and the title of Part Two, "Who's in Charge Here?"

Line drawings and diagrams by Barbara Ivins illustrate the discussions and experiments.

The book is highly recommended for use with children of elementary-school age. It is to be hoped that it can be published in a less expensive edition so that many children may gain knowledge about their bodies in the wholesome way which this book makes possible.

DOROTHY V. PHIPPS
Chicago Teachers College

Fundamentals of Organic Chemistry, James B. Conant, Albert H. Blatt. 413 pp. $4.00. The Macmillan Company. New York. 1950.

The title page of this book bears the legend "a brief course for students concerned with biology, medicine, agriculture, and industry." Although to cater to such varied interests in the brief space of this book appears to be rather ambitious, the authors have succeeded admirably in meeting these objectives.

The general approach may be considered as classical with a division of material into aliphatic and aromatic compounds. The authors have retained their characteristic introduction to the study of organic chemistry by a discussion of the alcohols. While this procedure has certain virtues, perhaps the principal drawback to this manner of introducing the subject resides in the necessity of delaying the development of systematic nomenclature until the discussion of the paraffin hydrocarbons in Chapter 3. At this time the application of the Geneva nomenclature to alcohols and alkyl halides is indicated. It is the reviewer's feeling that most teachers will find it necessary to elaborate considerably upon this treatment of the systematic naming of the alcohols and alkyl halides.

About two-thirds of the book is devoted to the chemistry of aliphatic compounds which is understandable since much space is given to the development of fundamental principles in this section. Interest is maintained by a good selection of industrially important reactions and processes.

Following the section on aliphatic compounds about 80 pages are devoted to the chemistry of aromatic compounds including a chapter on polynuclear aromatic compounds. This is followed by a chapter on alicyclic derivatives and a discussion of the more important naturally occurring compounds of this group including some simple terpenes, sterols, and

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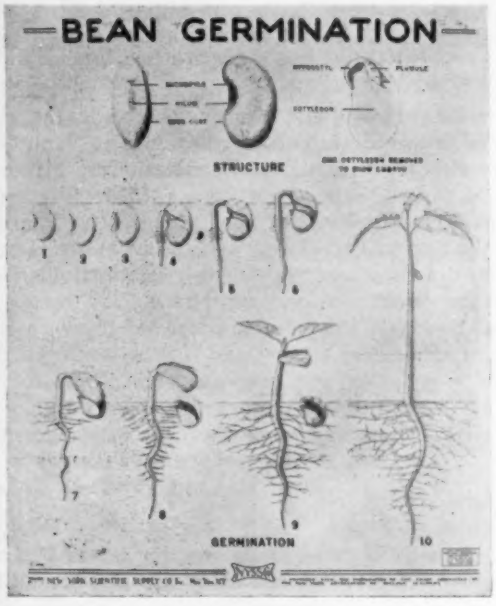

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This series of charts was planned with the cooperation of the Chart Committee of the New York Association of Biology Teachers. Unusual and painstaking care was exercised with regard to subject treatment, scientific accuracy, and artistic presentation.

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related vitamin and hormone products. A chapter on heterocyclic compounds with emphasis on biologically important members of this group follows, and the book concludes with a chapter on some of the simpler alkaloids and the more important synthetic drugs, antibiotics, and plant hormones.

The book is written in a clear, concise, and very readable style. It presents the fundamental principles and reactions of organic chemistry in a very adequate manner and is not cluttered with an excessive amount of factual material. The index appears to be well prepared and contains almost 1700 entries, including numerous alphabetical designations such as ACTH, ADP, ATP, etc. The typography is clear, formulas are well arranged, and the binding is simple but attractive.

ROBERT M. HERBST
Michigan State College

Man's Physical Universe. Third Edition. Arthur T. Bawden. 822 pp. Illus. $4.75. The Macmillan Company. New York. 1950.

In his preface the author states that the book "is intended to be used as a text for survey courses in physical science . . . in a program of general or liberal education"—this at the junior college level. It has been developed through Bawden's experience in teaching a physical science survey course at Stockton College, California. "This course," he says, "is designed to bring from the archives of physical science the most important facts and generalizations which have any bearing on . . . the problems of life today."

The Table of Contents suggests that the course and the text strive for breadth, rather than for depth of coverage. Each of ten units includes a brief introduction followed by six to nine sections of about eight pages each. End exercises consist of a list of questions, largely of a factual recall type, at the close of each section. The structure of the text and all its parts is made abundantly clear by the generous use of good section titles and side-headings. The format is traditional. Illustrations are well selected, although many users will wish they were larger and more numerous.

Teachers of courses such as Bawden has in mind will be interested in the emphasis he has placed on problem solving. Some may wish that more illustrations of, and references to, scientific methods and scientific attitudes were distributed throughout the text, rather than concentrated in the first unit. Most instructors will welcome the emphasis which the writer places on the social consequences of science and on the interrelationships among the several fields of science.

The style of writing is admittedly terse; often it possesses clarity in spite of the brevity imposed by broad coverage in a single volume. In some places the author's rigid and extensive marshalling of facts loses its compelling force and gives way to tedium. Frequently readers will wish that fewer concepts had been presented, and that these had been treated with logical development, rather than with mere statement of facts and principles.

Professor Bawden has prepared more extensive teaching-learning materials than he includes in his text. To teachers using the volume he offers an extensive and up-to-date bibliography, as well as a 60-page summary of the text (an item which he reports is of great interest to students!). He also supplies a list of motion pictures and other visual aids recommended for a course based on *Man's Physical Universe.*

ROBERT STOLLBERG
San Francisco State College

Let's Look Under the City. Herman and Nina Schneider. Illus. $1.50. William R. Scott, Inc. New York. 1950.

The sub-title of this little book, "Water, Gas, Waste, Electricity, Telephone," sums up rather completely the contents. The authors explain simply and with a minimum of detail how apartments are connected to each of these facilities. This would be a good book for parents to have read before walking past an excavation for a building with their children; they would be all set to answer that inevitable question, "What's that big pipe, Daddy?"

As a book for children to read for themselves, the appeal would be very limited. The language is too difficult for a young child who might be interested in the subject matter, while the subject matter is too elementary for an older child of better reading ability. The illustrations, by the Halls, are helpful in visualizing the connections between reservoirs and power companies and buildings.

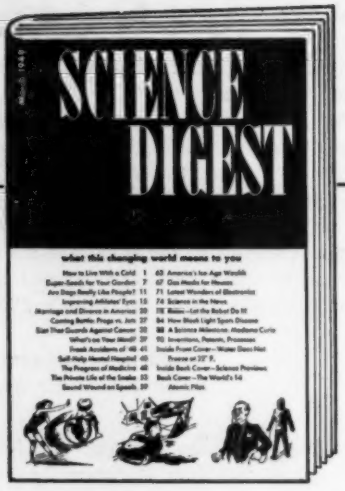
CLARE F. SMITH
Washington, D. C., Public Schools

Introduction to Semimicro Qualitative Chemical Analysis. Revised. Louis J. Curtman. 391 pp. Illus. $3.50. The Macmillan Company. New York. 1950.

This revision of Dr. Curtman's popular textbook includes changes in the laboratory section only. These changes are based on the results of researches carried out by the author and his students, the most extensive being in the detection of Group 2 cations. The restricted use of organic reagents in analysis is maintained. The appendix includes "Checking In" and "Checking Out," topics designed to increase the practical usefulness of the book.

The major divisions of the book are Introduction, Theory, Metal Ions and the Anions, Calculations, Laboratory Work, Anions and Complete Analysis of Mixtures, and an Appendix of 14 items.

ELBERT C. WEAVER
Phillips Academy
Andover, Massachusetts



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Implications—Elementary Level

(Continued from page 113)

Our science curricula must cater to the active intellectual curiosity of children. Our pupils should be helped to acquire understandings based on cause and effect relationships. These understandings should be functional, and capable of being used to interpret new experiences.

It is not denied that one of our functions is to help youngsters to acquire "facts." But we leave our task unfinished if we go no farther. We must recognize that children, even in their earliest years of schooling, are capable of distinguishing between a fact and an opinion and of weighing evidence. We should give our children opportunities to make generalizations for themselves; to question interpretations made by others; and to reach their own conclusions.

Another one of our objectives for the elementary curriculum should be to assist children in developing a desirable social behavior. They should be given opportunities to practice tolerance. They should learn to respect the opinions of others.

It may be possible on the higher levels of the elementary school to help children to realize the dependence of technology on science, and to understand that technological application is not the sole goal of scientific research.

Finally, Commissioner Smyth expresses the need for a scientifically literate citizenry in a free society. We, as elementary science teachers, can probably assist in the achievement of this goal through a humanistic approach. We frequently neglect in our teaching to help our pupils to understand how the developments in science and technology contribute to our culture and to our democratic way of living.

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A Study of Red Lead

By CHARLES H. STONE, Orlando, Florida, and GEORGE W. ANDERSON, Senior High School, Orlando

A sample of red lead heated in a test tube loses oxygen, and a residue of lead oxide, PbO, remains. So it appears that PbO is a component of the pigment. It seems possible that the constitution of red lead is $PbO + PbO_2 \rightarrow Pb_3O_4$.

When red lead is treated with hot dilute nitric acid, a brown product forms. But we know that PbO is readily soluble in the acid.

$$2\ PbO + 4\ HNO_3 \rightarrow 2\ Pb(NO_3)_2 + 2\ H_2O$$

Filtration follows this action, assisted by some hot water. The clear, colorless filtrate is then evaporated to dryness, using low heat, and white lead nitrate is formed. The brown residue on the filter paper is drained as dry as possible, the paper then removed, and spread out flat on a hot metal sheet to dry. Avoid too much heat. The dry brown powder, which is PbO_2, is then easily removed and preserved.

Implications—Secondary Level

(*Continued from page 113*)

If there *is* a way out of the dilemna, it can be found only in those forces which operate on the minds of men, leading them to act, as some believe, "from the heart." Education is certainly one such force; science education is another. If Dr. Smyth is right (and we believe he is), then educational philosophers must integrate science much more closely with the curriculum studies. Policy makers must be more willing to provide budgets that make good science teaching possible at all levels. Science teachers must make it their top objective, to develop citizens who are scientifically literate and who do not fear science because they understand its meaning in a free society.

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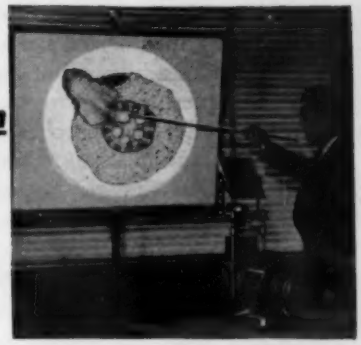

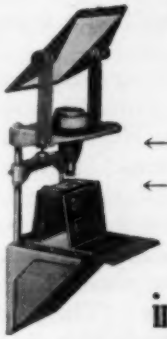

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Chats With Science Teachers—*Speaking of Speeches*

(*Continued from page 128*)

audience that you have given preparation to your speech, and will probably stop at the last card. As you gain experience, one card will be enough.

The strictly memorized speech is unsuitable for any occasion an adult will attend. Even in schools its value is questioned.

The most effective speeches are extempore. The word means "out of its time" in Latin, and implies that the speaker thought he was on the program tomorrow, hence left his notes at home. Only the extemporaneous speaker can fully watch his audience, vary his voice for best effect, and give the impression that what he says comes "right from the heart."

But the "free-wheeling speaker" faces dangers to his effectiveness! He may really think he is so good that he needs no preparation. He may not realize that he repeats his statements. He may ramble, using twice the time needed to make a point. Worst of all, he may grope for that climax he knows his speech should have to end!

Lyman Abbott (1835–1922), the noted New England preacher and editor, wrote: "The extemporaneous speech is like Longfellow's little girl. When it is good it is very, very good; and when it is bad it is horrid!" So you should practice the extempore address, carefully planned, memorized as to its points in sequence, spoken freely with the feeling that comes from the heart and not the paper. In due time such speeches of yours should be very, very good.

Other matters, small but important, would fill more space than may be allotted to this Chat. Your voice before an audience should be conversational, but strengthened to be heard clearly by the listeners farthest away. Your gestures should be few, and you must avoid any platform eccentricities, especially those that imitate some politician or evangelist.

You should speak in shorter sentences than you would write. Your audience must find it easy to catch your meaning at first hearing, for they can't go back and try for a better understanding.

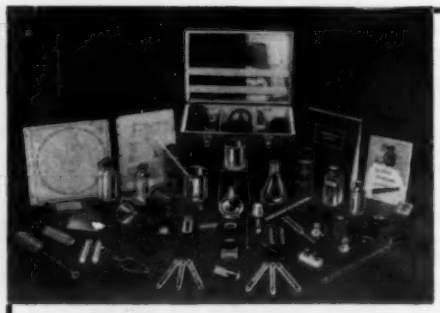
Your vocabulary should be somewhat larger and more dignified than in ordinary conversation, avoiding slang and "common" phrases. Yet you should use simple words, and speak them more clearly than usual. If your accent is of a region (as "Southern," "Mid-Western," or the remnant of some foreign tongue) make no attempt to change it—for this is a part of your personality.

If you wait until you are not nervous before making your first speech in a community, you will never speak at all! Piano wires never sing until the hammers hit! If your first speeches are under tension, that is fine.

Accept, therefore, all invitations to address an audience on a science topic. Practice gives skill, and confidence. Do not feel that your speech must shake the world! Be hopeful, yet humble, as to its consequences. Said the poet G. W. Langford:

> Speak gently! 'Tis a little thing
> Dropp'd in the heart's deep well;
> The good, the joy, that it may bring,
> Eternity shall tell!

Oak Ridge isotopes are being used in at least 450 separate biological and medical research projects in the United States, in addition to their manifold uses in industrial research. They will speed the battle against disease. They will help man to make more efficient use of nature's materials, to grow more food, to produce better manufactured goods. And virtually no observation was possible of the mechanisms, reactions, and pathways of elements and compounds in the body before isotopes were available to trace them.



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Science Teachers Fight Cancer

(*Continued from page 122*)

cer. No green lights, red lights or blue lights, no electric messages, no tablets swallowed before meals, no skeletal adjustments or muscular manipulations will cure malignant cancer. Although research in experimental medicine and surgery has revealed much in recent years, the bare fact remains that the ONLY cures for cancer are (1) surgery and (2) radiation by X rays or by radium.[2]

Third, make sure the seven danger signals are known. These are:

Any sore that does not heal
A lump or thickening in the breast or elsewhere
Unusual bleeding or discharge
Any change in a wart or mole
Persistent indigestion, or difficulty in swallowing
Persistent hoarseness or cough
Any change in normal bowel habits

Fourth, let us spread the word and urge our students to spread the word to friends, to families, to anyone and everyone. This is the power of education. Through our students we reach behind closed doors; we reach all types of people in all types of homes.

Teaching aids are available and are being developed nationally in abundance, and with professional skill, by thoroughly competent specialists in science education and audio-visual presentation. Filmstrips, posters, lantern slides, exhibits, motion pictures, pamphlets, booklets, teaching kits, and a long list of excellent free materials are yours for the asking.

[2] For a direct, forceful, authoritative, yet readable, presentation, see Garland, L. Henry, "The Roles of Surgery and Radiology in the Treatment of Cancer," *The American Journal of Roentgenology and Radium Therapy*, Volume LXII, No. 6, December, 1949.

Aids for Cancer Education

Recommended material for teaching about cancer includes: "Suggestions on What to Teach About Cancer," "Why Learn About Cancer?" "Teaching About Cancer,—Thoughts for School Administrators," "A Statement of Principles as a Guide to Cancer Education in the Schools," "Selected Facts and Figures about Cancer," "Youth Looks at Cancer," and "Cancer, A Challenge to Youth." Inquiries should be addressed to the Educational Division, American Cancer Society, 47 Beaver Street, New York City 4.

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—In a 1951 summer tour for science teachers? An NEA tour specially designed for science teachers and conducted in cooperation with a college or university is a real possibility. Such a tour running north from Chicago, for example, might be arranged to combine field observations of iron mining, copper mining, Great Lakes shipping, science industries, and the geology, plant, and animal life of the Great Lakes region. College credit might be granted. The NEA Division of Travel Service has expressed willingness to consider such a tour. If you are interested, send a note to this effect to Robert H. Carleton, executive secretary of NSTA, 1201 Sixteenth Street, N.W., Washington 6.

Scientists have gone six steps up the periodic table from Uranium in just ten years. The parade of synthetic elements which do not exist in nature began in 1940 when neptunium (93) and plutonium (94) were discovered. Late in 1944 elements 95 (americium) and 96 (curium) were discovered. In 1950, just three months apart, came the discoveries of 97 (berkelium) and 98 (californium). Practical uses for the newest atoms remain to be developed, but they are important in expanding man's understanding of matter. Dr. Glenn T. Seaborg has led the groups of scientists responsible for the discovery of all the synthetic elements heavier than uranium, excepting only element 93.

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Implications - College Level

(*Continued from page 113*)

work. The "case method," by which the student "looks over the shoulder of the scientists at work," allows such detailed and intimate acquaintanceship with important men, their methods, and their organization of observations into generalizations. Interspersed reading and lectures on the political, economic, and philosophical reaction to scientific ideas extend the influence of these ideas into the intellectual life of contemporary adults.

Teachers will find an abundance of potential material in each and every science. Much searching and organization will, however, have to be done to locate those materials of high potential value. Many topics of interest to the professional must be omitted to provide time for detailed consideration of a relatively few units or cases. Obviously the first step in organizing such a course is a list of course objectives thoughtfully developed.

An approach like that discussed by Dr. Smyth offers great possibilities for creating an adult public aware of what science is—and is not; of how scientists formulate, expand, and recognize a picture of the physical world; and of why basic science is important to every thoughtful person.

Surely, you have heard—

That *The Effects of Atomic Weapons* is rapidly climbing up the list of best sellers. Recently published by the U. S. Government Printing Office, the first printing of 10,000 was sold out the first day of issue. A second printing of 20,000 is now on sale—$1.25 from the Superintendent of Documents—and plans for a third printing have been announced. Two private publishers are in the swim with commercial editions of the book, which was prepared by the Atomic Energy Commission and the Department of Defense.

In addition to a wealth of scientific and technical information of the phenomena and effects accompanying an atomic explosion, the book discusses at length the health hazards associated with such explosions. Of particular importance is the discussion of radioactive contamination resulting from the use of radioactive material as a weapon.

With contributions of material from more than 100 military and scientific authorities, the book is illustrated by over 200 line drawings and halftone plates. Careful reading of this book will help science teachers to be prepared to react quickly and effectively should atomic disaster strike.

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You May Wish to Examine—

THE EARTH FOR THE LAYMAN—a bibliography in earth science. A selected list of 625 publications in earth science. Should be of value to teachers of earth science, conservation, and general physical science; to librarians; and to advanced students. American Geological Institute, 2101 Constitution Avenue, Washington 25. $1.00.

SPONSORING THE SCIENCE CLUB. This little bulletin suggests objectives for such clubs and presents procedures for guiding the activities of the teacher and club members to meet these objectives. Western Michigan College of Education, Kalamazoo, Michigan. 20 pp.; 10 cents.

THE USE OF FILMS IN ELEMENTARY SCIENCE. The purposes of this bulletin are to suggest objectives to which films may be expected to contribute, and to suggest methods for obtaining maximal values from the use of such films. Specific films are suggested for use in the various areas of elementary science. Western Michigan College of Education, Kalamazoo, Michigan, 24 pp.; 10 cents.

POINT FOUR AND EDUCATION. "We must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of under-developed areas." So stated President Truman in his inaugural address, January 20, 1949. Now known as "point four," this program became law on June 5, 1950, through the Foreign Economic Assistance Act of 1950. In *Point Four and Education*, the Educational Policies Commission examines this "bold new program" for its educational implications and responsibilities. National Education Association, 1201 Sixteenth Street, N.W., Washington 6. 28 pp.; 25 cents.

EDUCATION OF THE GIFTED. In the foreword to this bulletin, the Educational Policies Commission points out that "the educational needs of indiiduals who have superior intellectual capacity and of those who possess special talents in high degree differ in some important respects from the needs of other individuals." They urge that "to capitalize the rich resources of human talent which gifted children and youth possess, the schools and colleges must give special attention to the education of their gifted students." National Education Association, 1201 Sixteenth Street, N.W., Washington 6. 88 pp.; 35 cents.

SECOND GRADERS TRY THEIR WINGS. Description of a classroom project in aviation. Tells how second grade pupils at Bromwell School, Denver, learned some important things about aviation and the part it plays in our lives. Department of Elementary School Principals, National Education Association, 1201 Sixteenth Street, N.W., Washington 6. 32 pp.; 50 cents.

DISCIPLINE AND EMOTIONAL HEALTH. Report of second annual workshop on emotional health cosponsored by Cleveland Health Museum and Cleveland Teachers' Union. Doctors and educators, who were speakers for the workshop, have outlined their thinking on character development and personality disorders in children. Cleveland Health Museum, 8911 Euclid Avenue, Cleveland 6. 22 pp.; 25 cents.

Buffalo recently became the 29th city to assure its health researches of a dependable supply of necessary animals from its stray dog population. Some of the unwanted, unclaimed dogs and cats formerly destroyed by the SPCA under contract with the city will be saved to help scientists at the University of Buffalo School of Medicine and other medical institutions in that city investigate such health problems as cancer, heart disease, and blindness. Other major cities which peviously acted to save stray animals to assist medical research and teaching include Omaha, Cleveland, and Baltimore.

Meetings and Conferences

(*Continued from page 135*)

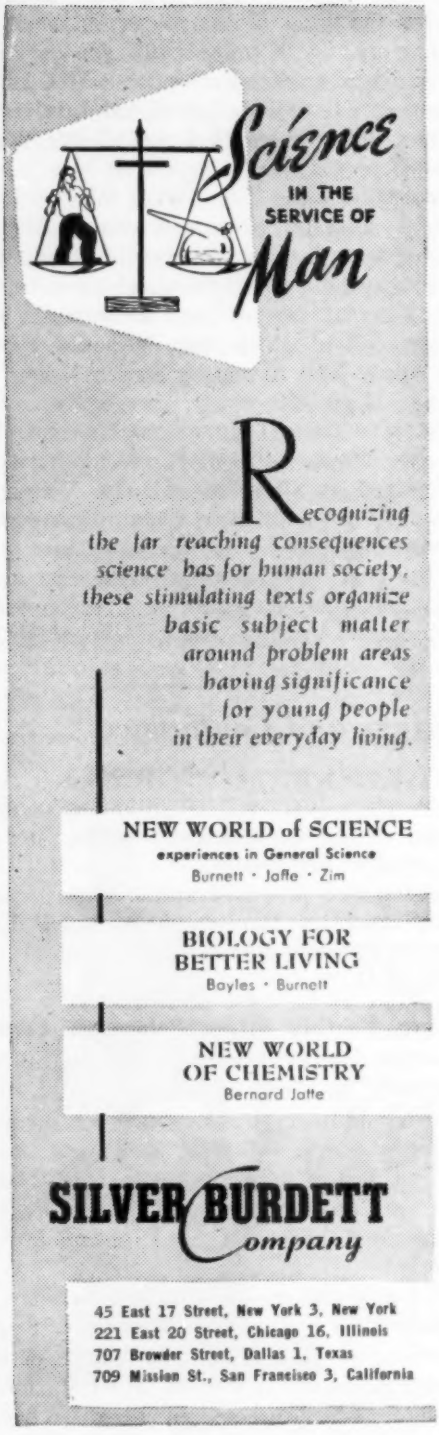
theater, where there will be an almost continuous showing of the latest scientific films; the biologists' smoker; and others.

Housing reservations should be arranged *now* by writing to Miss Louise D. Perkins, director, Cleveland Housing Bureau, 511 Terminal Tower, Cleveland 13.

Looking Farther Ahead—to San Francisco

The five-day 1950 summer session of NSTA will tee-off in San Francisco, June 28, with an all-day industry-science teaching conference. Marking the first full-scale association meeting, the major part of the program on June 29 and 30 will be built around a series of study-work groups on the general theme "Urgent Problems in Science Teaching."

Concluding the session will be a two-day meeting of the NSTA Board of Directors just prior to the opening of the NEA Representative Assembly in San Francisco (July 1–7). NSTA conference planning is being directed by Miss Archie MacLean, supervisor of science education, Curriculum Division, Los Angeles city schools, general chairman for the conference.



New Catalogs and Listings Received

AIDS TO VISUAL EDUCATION, The Stanley Bowmar Company, 2067 Broadway, New York City 23, contains an extensive filmstrip and record listing. WEATHER INSTRUMENTS AND TEACHING AIDS, Science Associates, 401 North Broad Street, Philadelphia 8, describes apparatus, maps and charts, and books for use in teaching about weather. SELECTED LABORATORY EQUIPMENT, Catalog No. 50, Schaar and Company, Chicago, lists apparatus and equipment primarily for use in chemical and biochemical laboratories. The W. M. Welch Manufacturing Company, 1515 Sedgwick Street, Chicago 10, offers to interested inquirers a booklet on the WELCH DENSICHRON. The Nuclear Corporation, 223 West Erie Street, Chicago 10, offers a descriptive folder on the CLASSMASTER, new radioactivity teaching device.

THE LIBRAY OF CLASSROOM TEACHING FILMS, films and filmstrips dealing with science concepts as they appear in elementary curricula, is described in a folder from Instructional Films, Inc., 330 West 42nd Street, New York City 18. The Audio-Visual Division of Popular Science Publications Company, 353 Fourth Avenue, New York City, has developed a series of TEACH-O-FILMSTRIPS in cooperation with the L. W. Singer Company and the World Book Encyclopedia. Titles cover all levels of science instruction.

Brandon Films, Inc., 1700 Broadway, New York City 19, lists notable foreign language and documentary films, plus outstanding American independent feature productions, in its 1950 catalog. The Franco-American Audio-Visual Distribution Center, Inc., 934 Fifth Avenue, New York City 21, has developed a bibliography and circulating exhibit of French science books. Also available is a film with English sound describing construction of the largest power dam in France.

To be placed on the mailing list for General Electric Company teaching aids, write to Mr. Robert D. Stanton, Educational Service Division, General Electric Company, 1 River Road, Schenectady 5, New York. Aids for health teaching may be obtained from the Metropolitan Life Insurance Company, Miss Marjorie L. Craig, Director, School Health Bureau, 1 Madison Avenue, New York City 10.

PICTURE SHEETS OF INSECTS. Twenty-five sheets available, each devoted to one common variety of farm or garden insect. May be purchased from Superintendent of Documents, U. S. Government Printing Office, Washington 25. Five cents each; send payment with order.

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Achievement Medal in Science

Clyde T. Reed, professor of biology, University of Tampa, Florida, received the University of Tampa Achievement Medal in Science for outstanding individual contributions. The award was presented at the university's June commencement services.

The citation read: "Your good work beyond your scheduled duties, your industrious research in areas of science outside of textbook materials, your contribution to the university in building up our biological and botanical laboratories far beyond those of most colleges in our class, your effective contributions to the progress of science and scientific organizations in Florida, have brought you to an advanced position among your fellow scientists throughout the country."

Professor Reed is NSTA state director for Florida.

It's New to Us—

JIMMY AND NANCY MEET MR. ATOM. Color filmstrip for supplementing the teaching of atomic energy at the elementary school level. Issued through the Council on Atomic Implications, Inc., Box 296, University of Southern California, Los Angeles 7. Purchase only, $5.00.

THE OXYACETYLENE FLAME—MASTER OF METALS. A new film dealing with the oxyacetylene process of cutting and welding metals. Reveals for the first time, it is claimed, in intricate detail what takes place under the intense oxyacetylene flame. Available on a loan basis without charge from the Supervising Engineer, Graphic Services Section, Bureau of Mines Experiment Station, 4800 Forbes Street, Pittsburgh 13.

THIS LAND OF OURS. Booklet designed to provide city dwellers with a graphic story of the importance of soil and water conservation. Public Affairs Committee, 22 East 38th Street, New York City 16. Thirty-five cents.

HELP AT LAST FOR CEREBRAL PALSY. Another Public Affairs Committee pamphlet. Estimates indicate a million persons in the United States are afflicted by this disability. The pamphlet describes the kinds of services that are available for training and educating cerebral palsy victims. Twenty-five cents.

THEY LIVE AGAIN. A black-and-white film story of Banting's and Best's momentous work on insulin. Portrays the two young scientists at work in their small laboratory and reveals the part Margie and other dogs played in the research. Running time, 11 minutes; service charge, $1.00. Available from American Medical Association Film Library, 535 North Dearborn Street, Chicago.

HOW TO KEEP YOUR BULLETIN BOARD ALIVE. A filmstrip giving suggestions for teachers. Produced by the Teaching Aids Laboratory, Ohio State University, 13 Page Hall, Columbus 10. Price, $2.50.

Joseph Priestley

(*Continued from page 131*)

solids enclosed over mercury in a glass tube. He did this by concentrating the sun's rays upon them with his burning glass. From mercuric oxide and, later, from the red oxide of lead, he obtained a gas of unique character. Let him describe it in his own words—

"With this apparatus," he says, "I endeavored to extract a gas from mercury oxide and I presently found that, by means of this lens, gas was expelled from it very readily. I admitted water to it and found that it was not imbibed by it. But what surprised me more than I can well express was that a candle burned in this air with a remarkably vigorous flame."

Among other tests he found that mice would live longer in this gas than in an equal volume of common air. He then tried breathing it himself. "The feeling of it," he says, "was not sensibly different from that of common air; but I fancied that my breast felt peculiarly light and easy for some time afterwards. Who can tell," he continues, "this pure gas may become a fashionable article of luxury? Hitherto only two mice and myself have had the privilege of breathing it."

From his further experiments he concluded correctly—that common air is not the "simple elementary substance, indestructible and unalterable" that my breast felt peculiarly light and easy for posed of one part of the new gas with four parts of an inert gas.

Captured by the sensational features of his discovery, he told his results to his fellow-scientists. The outstanding one of them was Lavoisier, politician as well as scientist, a rich official of the French Government, possessor of the most famous chemical laboratory in Europe. Like Priestley, Lavoisier had a compelling enthusiasm for experimentation. Unlike Priestley, he was trained as a chemist and fitted by nature to scrutinize the results of tests in an impersonal and dispassionate manner. It was to this man, Lavoisier, that Priestley had an opportunity to tell of the discovery and properties of his new gas, oxygen.

To Lavoisier the news was a fire-brand that set off a chemical revolution. All scientists of that time had been enthralled by the Phlogiston Theory of the famous German physician, Stahl. According to it, a metal oxide, which we now know to be a compound of the metal with oxygen, was considered a pure element, whereas the metal itself was deemed to be a compound of the supposedly elemental oxide with an ethereal substance known as phlogiston. All scientists of the eighteenth century subscribed to this theory, most of them with a religious fervor. They were in fact so devoted to it that they tried first to overlook the changes in weight that occurred during these reactions. For, of course, a metal gains in weight when it is oxidized and an oxide loses weight when it is reduced to a metal. To meet this objection, they finally came to the absurd conclusion that phlogiston must have a negative weight. Of all the scientists, only one was seriously suspicious, Lavoisier. Despite his superior talent, even he had been continually baffled at finding the correct theory for oxidation until Priestley's discovery of oxygen. The knowledge that this gas is given off from certain oxides when heated and that air is a mixture of this gas with an inert one, furnished Lavoisier with the clue that the oxide of a metal results from a chemical union of the metal with the new gas, which he named oxygen.

But even though the Phlogiston Theory was thereby overthrown as the result of Priestley's discovery, Priestley himself remained unconvinced and spent the remainder of his life in vain attempts to maintain the validity of the discredited Phlogiston Theory.

Why such loyalty? The answer may not be far to seek. After all, the pursuit of science had been only one phase of his activities. He had taken up the cause of the minority for freedom of religion. He had taken up the cause of the colonists in the American Revolution and again of the common people in the French Revolution. He had done this regardless of the increasing persecution which it brought him. Finally after escaping from a mob, he took flight to America.

What more natural to a person who had shown such loyalty to the rights of minorities among men than that he should show a similar loyalty to a theory which had become an outcast in science. We dare not criticise him. Perhaps we could do today with somewhat less of that fine, cold impersonal spirit of Lavoisier, if we could only put in its place some of Joseph Priestley's warmth of personality and breadth of human interests.

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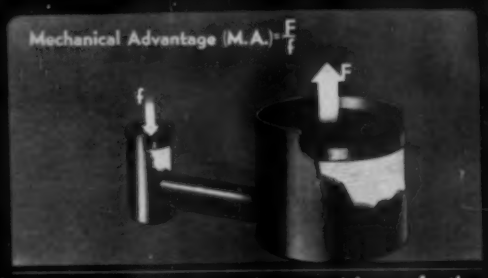

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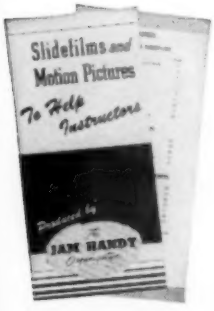

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